Applied Hydraulics

PNEUMATICS · ELECTRICAL CONTROLS

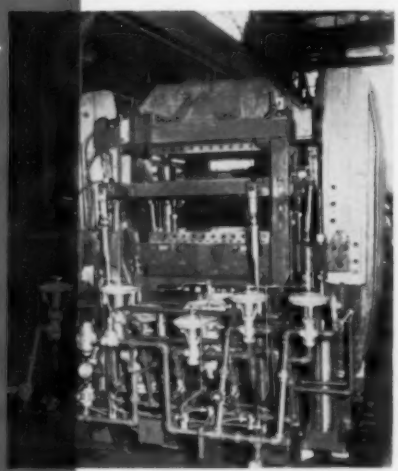
MARCH/1958

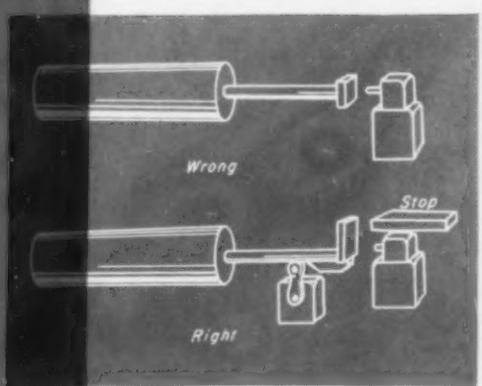
AIR CIRCUIT controls water-operated press
page 84

How MODIFIED VALVES smooth big indexing job
page 72

8 rules for using LIMIT SWITCHES
page 92

AIRCRAFT hydraulic system for safety, fast service
page 118





STEVENS RICE
UNIVERSITY MICROFILMS
SIBLEY HALL
ANN ARBOR MICH

THE MAGAZINE OF FLUID POWER

AN INDUSTRIAL PUBLISHING CORPORATION MAGAZINE

. . . read each month by 26,000 men who apply fluid power products to all types of machines and equipment

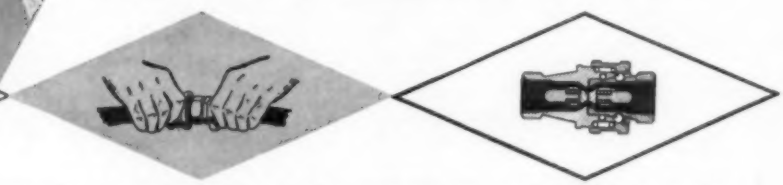
Wherever 2-way shut-off is required . . .

HERE'S THE COUPLING FOR THE JOB

HANSEN

SERIES HK®

TWO-WAY SHUT-OFF COUPLING



QUICK-CONNECTION *with* INSTANT AUTOMATIC FLOW

To connect Coupling, merely pull back sleeve, push Plug into Socket.

Blue section shows how torpedo type valves open in both Socket and Plug to permit free flow of gas or liquid through connected Coupling.

shuts off both sides of line . . . prevents loss of liquid, gas, or pressure

QUICK-DISCONNECTION *with* INSTANT AUTOMATIC SHUT-OFF

To disconnect Coupling, just pull back sleeve on Socket. No tools required.

Blue section shows how torpedo type valves contact valve seats in both Socket and Plug to provide instant seal of fluid in both ends of line.

WRITE FOR THE HANSEN CATALOG

Here's an always ready reference when you want information on couplings in a hurry. Lists complete range of sizes of Hansen One-Way Shut-Off, Two-Way Shut-Off, and Straight-Through Couplings—including Special Service Couplings for L.P. Gas, Steam, Oxygen, Acetylene, etc.

To connect a Hansen Two-Way Shut-Off Coupling, you merely pull back the sleeve and push the Plug into the Socket. To disconnect, just pull back the sleeve. No tools required. When Coupling is disconnected, similar valves in Socket and Plug shut off both ends of line—practically eliminate spilling of liquid or escape of gas at instant of disconnection.

Hansen Series HK Two-Way Shut-Off Couplings are available with female pipe thread connections from ⅛″ to 1″ inclusive. Available in brass or steel.

REPRESENTATIVES IN PRINCIPAL CITIES

SINCE 1915

QUICK-CONNECTIVE FLUID LINE COUPLINGS

THE HANSEN MANUFACTURING COMPANY

4031 WEST 150th STREET • CLEVELAND 35, OHIO

CIRCLE 58 ON READER SERVICE CARD

Distilled Writing gives you more for your reading time

You're probably a busy man. Most of our readers are. You can't read everything that crosses your desk. If you tried to, you'd never get your job done. To help you get more worthwhile facts for your reading time, the content of this issue has been distilled.

What's Distilled Writing? It's copy with the extra words squeezed out. It's a process for telling all the facts as clearly and simply and briefly as possible.

For example: we take . . .

. . . this kind of writing . . .	and distill it to this:
eliminate unwanted vegetation	kill weeds
It is used to rupture missile frames in flight to initiate aerodynamic disintegration.	It makes missile frames explode in flight.
formation of iron oxide binding the two surfaces	rusted together

Why we distill our material: Readers don't have time to wade through doubletalk. Our research department told us that we - like other publishers - were taking too much of our space and your time to get the facts across.

How we developed Distilled Writing: First we hired Dr. David Kinsler to head up our distilling on a fulltime basis. He works with all our editorial staffs, teaching sharp concise writing.

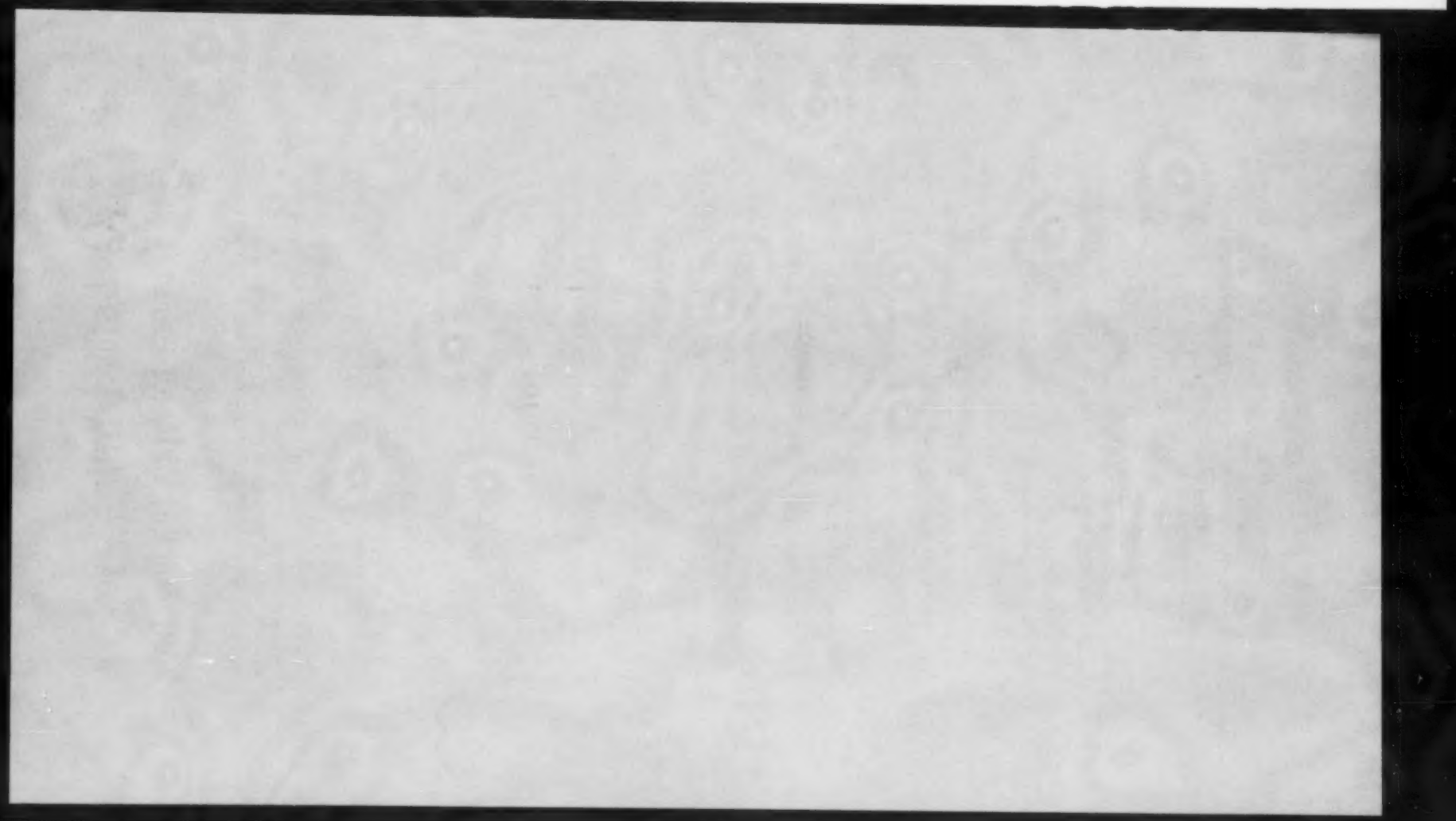
Second, we retained Robert Gunning, the top authority on readable writing, as our consultant.

Third, we put every line of copy - whether staff-written or by an expert in the field - through the distilling process before it's printed. Our whole editorial effort is aimed at telling the story brightly, clearly, briefly.

Rule number 1 of our editorial code: every article gets only as much space as it really needs. Not one line more.

Result: The story that used to take four pages is now told in 2 or 3. The two-page article probably gets one page. This is not a digesting process: all the facts are still there. Only the verbiage is gone.

What does this mean to you? Shorter articles mean more articles per issue. We can cover more subjects, give you broader coverage of the field. More articles . . . more easily-read articles . . . more subjects covered: Distilled Writing gives you more for your reading time.



NEW HYDRAULIC FLOW CONTROL VALVE

Calibrated for Precision Control

3/8" VALVE
Actual Size
$16.00

HANNA *Flo-Set 1000* VALVES

are used for controlling flow of petroleum liquids, water and synthetic hydraulic fluids.
Pressure to 1000 psi.
Sizes ¼", ⅜", ½" and ¾"
Temperatures –40° F to +250° F

To meet the demands for precision control of hydraulically powered equipment, Hanna offers this new calibrated speed control valve. Flow can be accurately regulated from zero to desired rate by turning the adjusting sleeve. Once set to the desired flow rate the valve can be "locked". Calibrations assist in setting the valve to pre-determined flow rates.

The new Flo-Set 1000 Valves are the result of over 50 years of Hanna design and manufacturing experience in the field of fluid power. They are built to close tolerances with quality materials and like all Hanna products they are offered only after extensive laboratory testing and field experience. Their performance is guaranteed for the service specified.

Ask your Hanna Representative listed in your classified directory and Thomas' Register for complete information—or write us for details.

Hanna Engineering Works

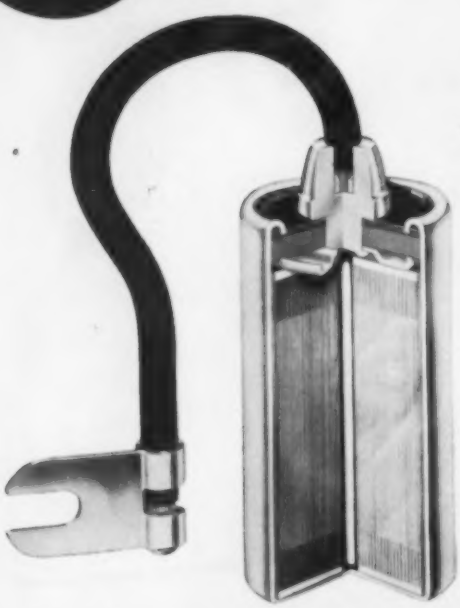
HYDRAULIC AND PNEUMATIC EQUIPMENT . . . CYLINDERS . . . VALVES

1741 Elston Avenue Chicago 22, Illinois

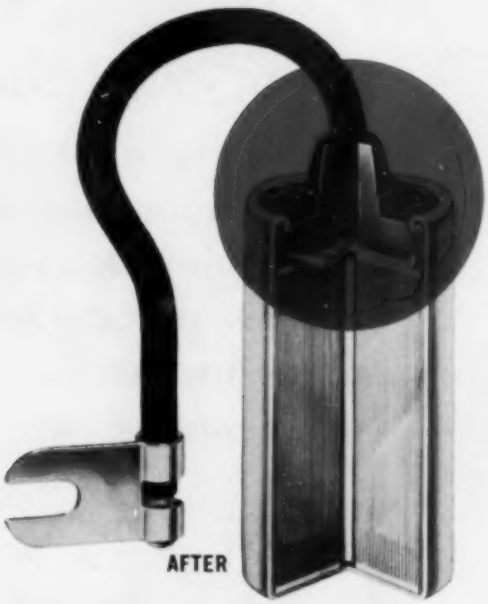
CIRCLE 57 ON READER SERVICE CARD

needed: *a molded condenser seal to meet 10 rigid requirements*

found: *injection-molded cap engineered by minnesota rubber*



BEFORE



AFTER

The Echlin Manufacturing Company of New Haven, Conn., needed a new end piece for their automotive condenser—one that would give good performance, improve appearance and cut costs.

They took their problem to the engineers of the Minnesota Rubber Company. The Echlin designers listed 10 requirements for the condenser cover. It should have high dielectric strength, a specified durometer, an absence of moisture absorption and oil resistance.

Dimensions were to be stable and constant, and no permanent deformation after compression could be tolerated. In addition, the seal had to retain its resilience at automotive engine temperatures, be physically attractive and bear the firm's name. And, it should be capable of being produced in quantity at a reasonable price.

Rubber injection molding techniques originated by Minnesota Rubber solved all these problems. Minnesota Rubber researchers developed a special Buna S compound that enabled them to completely fulfill specifications.

The result was a better product; one that looked better and bore the Echlin name. Also, the new condenser cover was a one-piece unit. It replaced a unit consisting of a screw machine part, a double lamination piece and a spring washer. Finally, this more satisfactory seal cost about eight percent less to manufacture!

The Minnesota Rubber Company, originators of modern rubber injection molding, can make similar improvements on components you may need. For full information, write to the department and address listed below. Order your 16-page brochure detailing Minnesota Rubber facilities at the same time.

Need low-cost prototypes? Another technique pioneered by Minnesota Rubber is KOTOKAST. This technique means rapid delivery of prototypes for experiment and development at a cost far below those made by standard processes. PROTOTYPES by KOTOKAST, another step forward by Minnesota Rubber Company.

Note: KOTOKAST is a trademark of the Minnesota Rubber Company.

MINNESOTA RUBBER COMPANY • 3630 Wooddale Avenue, Minneapolis 16, Minnesota, Department 103

for color in rubber
for parts of silicone rubber
for versatility in rubber
for applied product development

MINNESOTA MR RUBBER

Rainbow Rubber Division
Silicone Rubber Division
Plastics and Latex Division
Research and Development Division

CIRCLE 87 ON READER SERVICE CARD

Applied Hydraulics

VOLUME 11/NUMBER 3

MARCH 1958 THE MAGAZINE OF FLUID POWER

CIRCUIT ANALYSIS

EQUALIZER CIRCUIT LEVELS A 675-SQ. FT. PLATEN 69
By N. K. Willis and John Williams, Jr.

HOW MODIFIED VALVES SMOOTH A BIG INDEXING JOB 72
By Martin H. Benston and A. M. Lane

FOUR PUMP CIRCUIT CONVERTS A MECHANICAL PLANER 74
By James K. Tufts and J. C. Carpenter

PILOTED RELIEF VALVES KEEP POWER REQUIREMENTS LOW .. 77
By W. R. Stamler

HIGH PERFORMANCE SERVOS CAN BE USED ON MACHINE TOOLS 98
By S. F. Watanabe

HYDRAULIC SEQUENCING GIVES FAST ACTION 104
By J. R. Fawcett

PNEUMATICS

AIR PRESSURE TIMES CYLINDER 82

AIR CIRCUIT CONTROLS WATER-OPERATED PRESS 84
By Robert Guggenheim

AIR GIVES 100-LB PUNCH 112
By M. G. Saake

MOBILE EQUIPMENT

VALVE OPERATING LINKAGE REDUCES FLUID LINE LENGTH 80

GEAR MOTORS DRIVE EARTH AUGER 106
By J. A. Swanson, Oliver Hoff and Edward Srnensky

PRODUCT APPLICATION

8 RULES FOR USING LIMIT SWITCHES 92
By D. Fitzpatrick

1000-PSI VALVE MANIFOLD USES BOLTED ALUMINUM PLATES ..114

AVIATION SECTION

LOCKHEED ELECTRA'S HYDRAULIC SYSTEM DESIGNED FOR SAFETY, FAST SERVICE 118
By Harlan Asquith

CAM-ACTUATED SERVO VALVES CONTROL WIND TUNNEL 120
By John McComber

DEPARTMENTS

10....Fluid Power Lines
14....Future Events
20....Letters to the Editor
30....Briefs
58....New Products
64....Useful Literature
150....Post Scripts of Industry
154....Market Place
155....Advertisers' Index

FRANCHISE CIRCULATION DISTILLED WRITING

copyright 1958 by The Industrial Publishing Corporation

BPA

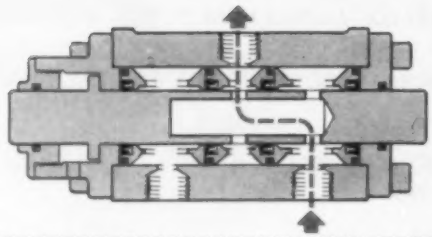
WHO says all control valves are pretty much alike?

This exclusive patented*

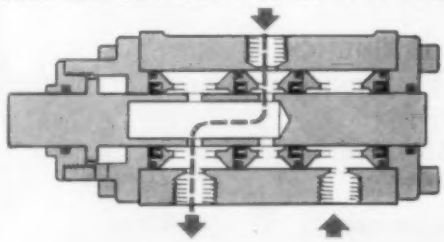
Quick-As-Wink®

construction

Plunger Right. Air flows through the inlet—and the hollow, polished stainless steel plunger—and out to the air operated device.



Plunger Left. Inlet air is blocked off. Air from the air operated device is exhausted through the hollow plunger, and out the exhaust connection.

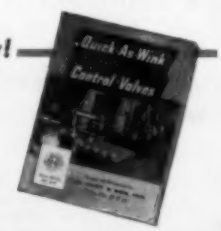


assures users unparalleled efficiency, economy, dependability and satisfaction

Quick-As-Wink Control Valves are in a class by themselves! Our exclusive patented* valve chamber construction, that accurately positions the "O" rings and the "U" packers without mechanical pressure, meets the most exacting service requirements. No direct flow across the packings, greatly prolonging their life. No lapped joints. No metal to metal seating. Hundreds of different types and actions. Sizes from ¼" to 4". Get full details.

*U. S. Pat. No. 2,645,450

Write for* BULLETIN NO. 571 *Today!



Quick-As-Wink®
AIR AND HYDRAULIC
Control Valves

***Mfd. by* C. B. HUNT & SON, INC., 1995 East Pershing St., Salem, Ohio**

— Engineering and Sales Representatives in the Principal Cities —

Applied Hydraulics

THE MAGAZINE OF FLUID POWER

Published monthly by
THE INDUSTRIAL PUBLISHING CORP.
812 Huron Road, Cleveland 15, Ohio

IRVING B. HEXTER ..... President
LESTER P. AURBACH ..... Executive Vice-President
EDWIN M. JOSEPH ..... Vice-President
LEE HAAS ..... Vice-President

STAFF

PAUL ROLNICK ..... Editor and Publishing Director
ALLAN E. MORRIS ..... Executive Editor
KEITH A. CARLSON ..... Associate Editor
BERT BENKENDORF ..... Associate Editor
SUSANN SLIVA ..... Editorial Assistant
SCHOLER BANGS ..... Western Editor, Los Angeles Office
JOHN A. LANKESTER, A.R.Ae.S. ..... European Editor
ALARIC MAUSSER ..... Art Director
N. G. KISER ..... Circulation Director
ALAN KICHLER ..... General Mgr. Franchised-Dealer Dept.
R. V. STARKS ..... Mgr. Reader Service Dept.

SALES OFFICES

CLEVELAND 15 ..... SUperior 1-9622
R. D. SHATTUCK

NEW YORK 17 ..... MUrray Hill 7-3420
LEE HAAS, Vice-President
V. R. STEIN, Administrative Assistant
RONALD ROSE, Eastern Representative
60 E. 42nd St.—Room 836

CHICAGO 11 ..... WHitehall 3-1655-56-57
CHARLES F. GEYER, Manager
S. R. TRACY
520 N. Michigan Ave.—Room 704

LOS ANGELES 57 ..... DUnkirk 7-5104
ALAN T. CAZIER, Manager
WILLIAM MILLS
Room 8, Granada Building
672 South Lafayette Park Place

LONDON S.W.1 ..... Victoria 2608
JOHN A. LANKESTER, A.R.Ae.S. ..... Manager
31 Palace St., Westminster

SUBSCRIPTION in United States and possessions—$5.00 per year; Canada—$6.00 per year; Foreign—$7.00 per year, except United Kingdom. United Kingdom subscription £ 3.0.0 per year, payable in Sterling to our London Office. Single copy price, this issue, $.50. All subscriptions subject to individual acceptance by the publisher.

AFFILIATED PUBLICATIONS: COMMERCIAL REFRIGERATION & AIR CONDITIONING, PRECISION METAL MOLDING, FLOW, INDUSTRY & WELDING, OCCUPATIONAL HAZARDS, MODERN OFFICE PROCEDURES, AERONAUTICAL PURCHASING, MATERIAL HANDLING ILLUSTRATED, and WELDING ILLUSTRATED. Member, Business Publications Audit of Circulation, Inc.

Accepted as controlled circulation publication at Pontiac, Illinois. Please return 3579 forms to 812 Huron Road, Cleveland 15, Ohio.

Useful Literature

Condensed Catalog Covers Anchor Line

Users and manufacturers of hydraulic equipment will find the Anchor Condensed Catalog No. 57-S a most valuable adjunct to their engineering or maintenance files.

It contains a condensed, yet very complete presentation of the Anchor Line of Hydraulic Hose Assemblies, Couplings and Fittings. The Anchor Line is so reviewed as to greatly simplify selection of the correct Hose Assembly, Coupling or Fitting for any given application.

Included in this catalog are descriptions of the most standard Anchor Products, including Anchor Ductile Sleeve Couplings and other permanently applied Couplings with 2-Wire Braid Hose for high pressures, and with 1-Wire Braid Hi-Burst 2-Rayon Braid, or Spiral Wire Braid for medium and low pressures.

Also described are Anchor Reusable Couplings which include the commercial Duloc Couplings for QW and QWR Hose and Anchor Standard Reusable Couplings with 2-Wire Braid Hose for high pressures, with 1-Wire Braid Hose, Hi-Burst and Standard 2-Rayon Braid Hose for medium and low pressures.

Anchor FLANCO 4-Bolt Split-Flange "O"-Ring Couplings and Clamp-Type Hose Couplings for quick, easy emergency repair are listed.

The right fitting to suit practically any piping situation can be found in the Anchor Line of Adapter Unions and Pipe Fittings with its wide range of sizes and thread combinations.

Also shown are the new Anchor SAE Adapters and Fittings designed to SAE Straight Thread "O"-Ring Boss standards, which are carried in stock.

This condensed catalog of Anchor standard stock products is now available on written request. Write Anchor Coupling Co. Inc., 322 North Fourth Street, Libertyville, Illinois, and ask for Catalog No. 57-S.

SAVE Time, Expense and Effort

with

ANCHOR FLANCO®

4-Bolt, Split-Flange, "O" Ring

CLAMP

—with the **TILT-PROOF** *and* **BLOW-OFF PROOF DESIGN**

Flanco Split-Flange Couplings provide an easily-made, leak-proof "O" Ring Head connection. There are no threads to wear out, or tapered seats to groove—no wedging of pump or valve bodies by tapered pipe threads! The use of gaskets and sealing compound is eliminated—there is no spiral leakage. The higher the pressure, the tighter the "O" Ring seals!

Anchor Split-Flange Clamp design gives you a tilt and blow-off proof clamp. By locating the plane of the split-flange clamp half bolt centerlines so that it passes through the center of force of the flanged head on the split-flange clamp half, unbalanced moments are eliminated. This patented design principle prevents tilting of the clamp half and extrusion of the "O" Ring.

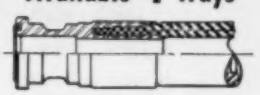
Anchor Flanco Split-Flange Couplings can be used to connect hose assemblies to valve or pump bodies, or, in pairs with connector plates, to connect hose to hose, or hose to pipe. They are available in sizes from ½" to 3" I.D. hose and in low or high pressure styles to provide a dependable, trouble-free connection.

A new Anchor Swivel Joint, with full 360° swivel, provides maximum convenience and flexibility in installation and avoids twisting and distortion of hose. They are available in all standard angles for high pressure 2-wire braid pressed-on hose assemblies from ½" to 2" I.D.

Andy Anchor Says:

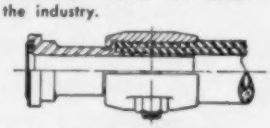
For the complete story of the many advantages offered by Flanco Split-Flange, 4-Bolt, "O" Ring Head Couplings and their time and money saving features, write for Catalog No. 401.

Available 4 Ways



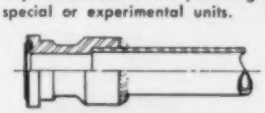
Pressed-On Couplings

Streamlined Couplings, factory applied to make dependable hose assemblies, utilizing the same time-proven hose swaging methods which have made Anchor the leader in the industry.



Clamp-Type Couplings

Ideal for making emergency repairs in shop or in the field with a minimum of down time. Also exceptionally well-suited for the plumbing of special or experimental units.



Weld-Type Couplings

Used to connect pipe or tubing to hydraulic hose, or for coupling pipe to system components, or pipe to pipe with quick, sure, leak-proof connections.

Stem-Angles

Available in Pressed-On or Clamp-Type Couplings, these stem-angles come in 22½°, 30°, 45°, 60°, 67½° and 90° basic angles. With the Flanco Swivel Split-Flange's 360° swiveling feature, universal positioning is provided.

ANCHOR COUPLING CO. INC.

322 North Fourth Street, Libertyville, Illinois
Branch Offices: Dallas, Tex.; Plymouth, Mich.

CIRCLE 11 ON READER SERVICE CARD

air circuitry:

a new term of importance to control engineers.

Air has come of age as a control medium. No longer is it confined to the simple jobs of pushing a clamping device, moving a lever, or blowing chips. No longer is an air circuit just a valve, reservoir, and cylinder. Today the most complex of industrial control problems can and are being solved efficiently with air.

Today, pneumatic circuits can be interconnected. They can be set to control a complex sequence of operations *automatically*. They can be combined with electrical circuits. There is *no* control problem you have that can't be solved successfully with air.

The new role that pneumatic control can play in industrial operations demands a new way of thinking about air control. It demands a new way to describe control by air—a new name that suggests some of its limitless control possibilities. That's why Westinghouse Air Brake Company is now using the term "air circuitry" to describe the application of air control to automation.

Westinghouse Air Circuitry, we realize, has to be more than *just as good* as your present means of control. It has to offer you *extra advantages*. And it does.

Chief among these is its extreme simplicity. The devices themselves are uncomplicated mechanical devices. They have few moving parts. They are easy to service by any mechanic. The circuit connections are made with pipe—and what could be simpler than that!

This extreme simplicity brings with it other important "pluses" for air circuitry. The simple equipment is unusually reliable—there are few moving parts to wear out or get out of adjustment. The devices are sturdy and durable. They require very little maintenance. What maintenance there is can be handled without the services of highly trained technicians.

Above all, remember: no means of control is as *safe* as air.

Air circuitry can help you simplify your control problems. It can help you get accurate answers to your automation problems on any industrial machine . . . in any industrial process. And Westinghouse Air Brake Company can help you with the engineering of a suitable system. Westinghouse has been in the control engineering business for 80 years now. It has been at the forefront of the development and improvement of air control equipment and its applications.

For more information on Westinghouse Air Circuitry—how it has helped other companies, how it can help you—write for your copy of "Basic Pneumatic Control," or call our nearest sales office.

WESTINGHOUSE AIR BRAKE COMPANY, INDUSTRIAL PRODUCTS DIVISION, WILMERDING, PA.

CIRCLE 146 ON READER SERVICE CARD

T-J spacemaker cylinder

Quality Engineered

to give quality results

with Extras . . . at No Extra Cost!

You get more—much more—when you specify and use any of T-J's complete line of Spacemaker cylinders. The Spacemaker is engineered to give you better, more accurate, and longer service—offers, exclusively, many extras . . . that are STANDARD, AT NO EXTRA COST!

Designed to eliminate tie-rods, providing greater strength . . . saves space . . . reduces manhours and costs in all push-pull-lift operations. OFF SHELF DELIVERY in a wide range of styles and capacities, with 64,000 combinations. Write for catalog SM 56-2 with complete engineering details. The Tomkins-Johnson Co., Jackson, Mich.

METAL PISTON ROD SCRAPER . . . Standard at No Extra Cost!

NEW "SUPER" CUSHION FOR AIR . . . Standard at No Extra Cost!

CHROME PLATED CYLINDER BORES AND PISTON RODS . . . Standard at No Extra Cost!

ONE PIECE PISTON . . . Standard at No Extra Cost!

NEW "SELF-ALIGNING" MASTER CUSHION FOR HYDRAULIC USE . . . Standard at No Extra Cost!

NO TIE-RODS TO STRETCH . . . Standard at No Extra Cost!

STREAMLINED DESIGN . . . Oil Pressure to 750 P.S.I.—air to 200 P.S.I. Standard at No Extra Cost!

FORGED SOLID STEEL HEADS . . . Standard at No Extra Cost!

T-J TOMKINS-JOHNSON
RIVETORS AIR AND HYDRAULIC CYLINDERS CUTTERS CLINCHORS

SEE US AT BOOTH 1423
A. S. T. E. SHOW

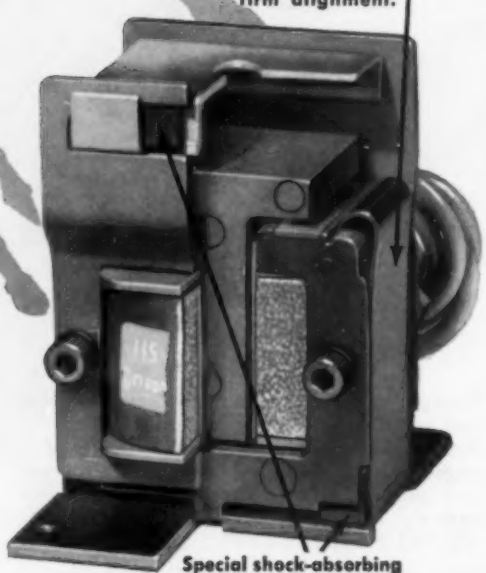
we've gentled the bucking bronco!

Decco two-way shock mounting greatly reduces self-destruction in your solenoids.

The greatest cause of solenoid failure is the impact on the solenoid structure of the unspent stroke force.

Decco recognized this problem years ago and engineered effective, two-way recoil material into the basic design. Decco's patented shock mounting is well known in industry. It is responsible, along with quality construction, for Decco Solenoid's substantially greater service life and a substantial saving of down-time and dollars to their users.

Decco engineers will be happy to discuss your solenoid requirements without obligation. Special solenoids engineered to your needs.



Tempered alloy steel spring absorbs vibration—holds assembly in firm alignment.

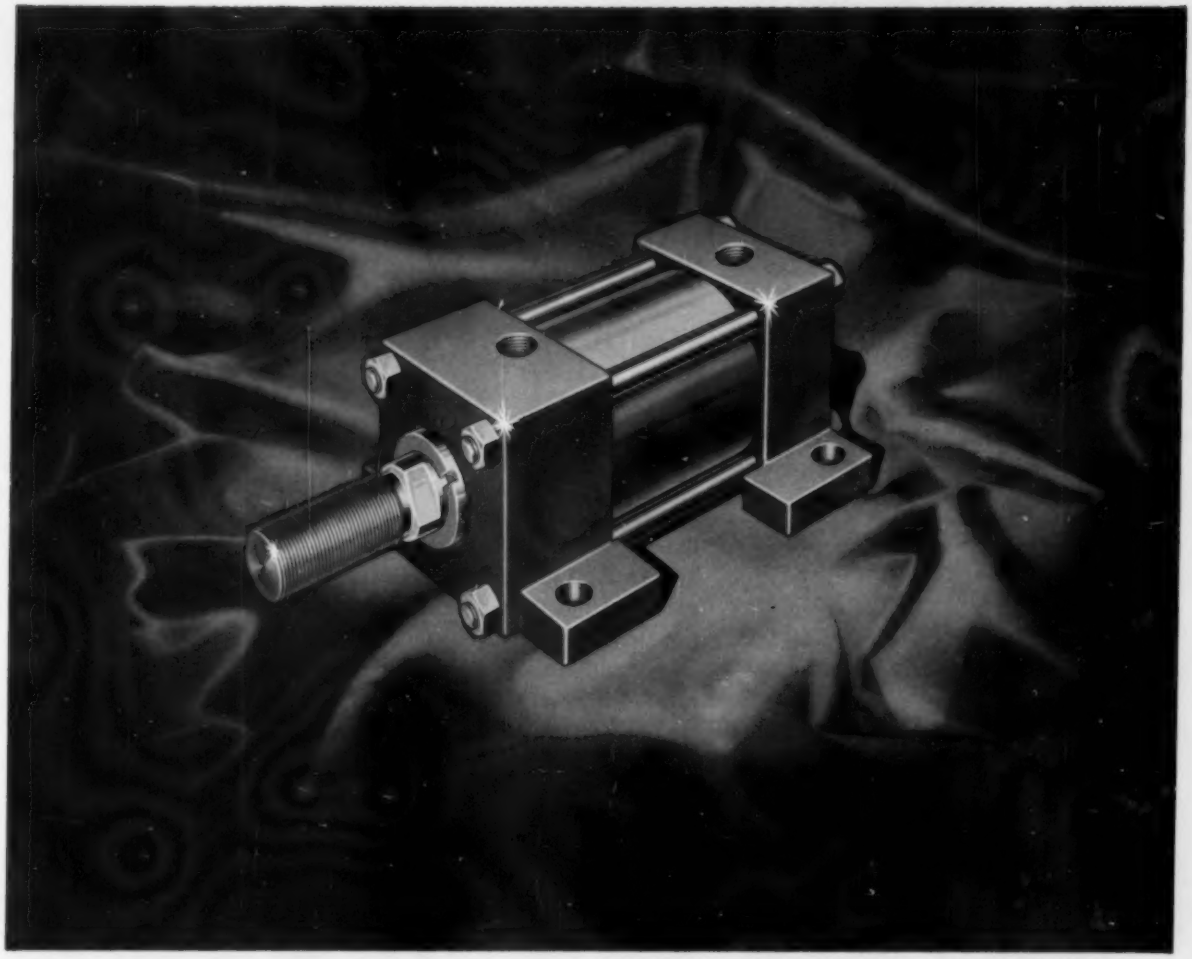
Special shock-absorbing compound bumpers cushion stroke—greatly improve the service-life of the solenoid.

FOR COMPLETE INFORMATION ON ALL DECCO INDUSTRIAL SOLENOIDS • WRITE:

Decco SOLENOIDS THE HEART OF DEPENDABLE AUTOMATION EQUIPMENT

DETROIT COIL COMPANY

2435 HILTON ROAD, FERNDALE 20, MICHIGAN



Illustrated—Logan Super-Matic Cylinder Meets J.I.C. Standards

Look to Logan

the ultimate in hydraulic cylinder design

FREE SEND FOR THE "LOGAN CALCULATOR"

MEMBER: Natl. Mach. Tool Builders' Assn.; Natl. Fluid Power Assn.

LOGANSPORT MACHINE CO., INC.
832 CENTER AVENUE, LOGANSPORT, INDIANA

PLEASE SEND COPY OF CATALOG:

- ☐ 100-1 AIR CYLINDERS
- ☐ 100-2 MILL-TYPE AIR CYLS.
- ☐ 100-3 AIR-DRAULIC CYLS.
- ☐ 100-4 AIR VALVES
- ☐ 100-5 LOGANSQUARE CYLINDERS
- ☐ 100-6 ULTRAMATION CYLINDERS
- ☐ 300-2 PRESSES
- ☐ FACTS OF LIFE
- ☐ 200-1 HYD. POWER UNITS
- ☐ 200-2 ROTOCAST HYD. CYLINDERS
- ☐ 200-3 750 SERIES HYD. CYLINDERS
- ☐ 200-4 AND 200-7 HYD. VALVES
- ☐ 200-6 SUPER-MATIC CYLS.
- ☐ 300-1 CHUCKS
- ☐ ABC BOOKLET
- ☐ CIRCUIT RIDER

TO:

NAME _____ TITLE _____

COMPANY _____

ADDRESS _____

CIRCLE 78 ON READER SERVICE CARD

FLUID POWER LINES

about applied hydraulics

THEY'RE OFF . . . Getting the ponies started together is a job for high reliability starting gates. A misfire can bring big law suits and frustrated horses. The job of getting cylinders started together, and keeping them that way, has produced many different circuits for synchronizing. Theoretically, if you put the same amount of fluid into two identical cylinders, they will move together. In practice, this is difficult because of unequal loading, internal leakage, and manufacturing tolerances in cylinders.

An actual application where synchronization is a primary factor is detailed in *Equalizer Circuit*. Two cylinders are installed at each corner of a 675-sq. ft. press platen to keep the platen level. These are interconnected to exert a force on any corner which tends to hang up, and to slow down the other corners.

SOMEBODY SAID . . . it couldn't be done, but engineers who designed the drilling machine described on page 72 had to find out for themselves. For smooth operation of the indexing system, the index cylinders had to retract momentarily to relieve force on the locking pin. By using exhaust fluid from the pilot section of the directional valve to actuate a modified sequence valve, they were able to get just the timing needed. Smooth starting of the index is done with a modified flow control valve.

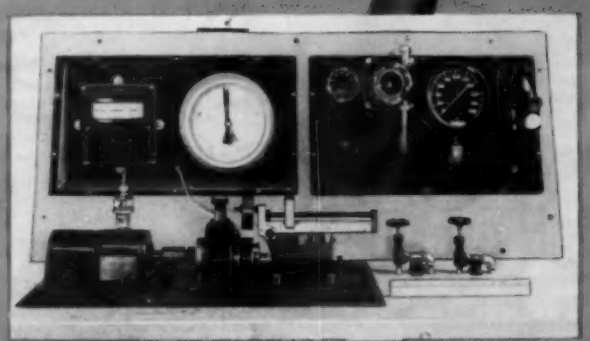
LATEST FROM PARIS . . . Down in Paris, Kentucky, they've designed equipment for controlling the loading of coal into box cars. With an almost-human reasoning, two cylinders move the cars along for even loading. Because these cylinders operate only intermittently, the pumps are unloaded much of the time through vented relief valves. Most of the hydraulic control is in the pilot circuit which actuates the relief valves.

TAKING A CUE . . . from electrical relays which lock in through one of their normally-open contacts, the air circuit discussed in *Air Pressure Times Cylinder* has a pilot-operated valve which locks itself in even after actuating pressure is removed. Metering air to the valve's diaphragm operator times a core assembly operation.

AIR AND WATER . . . usually don't mix, but they work fine together in controlling the rubber molding press described on page 84. Much of the versatility of this machine depends on the air-valving which is controlled both electrically and manually. Diaphragm-operated hydraulic valves are actuated by a 30-psi air system.

BIG BLOW . . . is made bigger when hydraulic motors flex the throat walls in NACA's wind tunnel. Positioning the 76-ft. stainless steel plates was a problem in servo design. Input to the system is from a series of cams; servo valves give the follow-up.

Low Cost Rotary Seals



Precision test stand especially developed to test efficiency of "O" rings as low cost rotating shaft seals.

Precision "O" Rings from Compound 158-80 provide the answer to a problem for a manufacturer of Oil-Hydraulic Pumps.

1. Eliminated costly hand lapping
2. Reduced friction—increased life
3. Sealed 2000 P.S.I.

Compound 158-80, with built in lubrication, is especially suitable for those jobs where friction is a problem. They are compression molded, rigidly inspected —the finest made!

Have a sealing problem? You'll find the answer at Precision! There's a Precision engineer ready to help you in "O" Ring specification and product design.

Get your free copy of our Engineering Data Sheet on Compound 158-80.

Specify Precision—first in quality

Precision Rubber Products Corporation

"O" Ring and Dyna-seal Specialists

Dept. 1, Oakridge Drive, Dayton 7, Ohio **Canadian plant at: Ste. Thérése de Blainville, Québec**

SKINNER'S NEW 2-WAY VALVE OFFERS

big capacity — high pressure

Here's the second new line of valves designed to answer your control "puzzles." This new line, called the R Series, is a two-way, pilot-operated piston valve with ¼" orifice and ¼" NPT. It is available normally open or normally closed and operates on a pressure differential of 5 to 200 PSI. This new R Series also includes an Explosionproof line in normally open and normally closed construction. A normally closed version will be available soon to operate on pressures up to 1000 PSI.

This new R Series uses the famous Skinner V5 Operator and will control air, water, oil and semi-corrosive media. The normally open version can, on request, be supplied with pilot exhaust piped to body outlet port.

A wide selection of coils—high-temperature, waterproof and standard—for common AC and DC voltages is available, and there is choice of electrical connections such as Automotive Terminals, Grommet and Conduit.

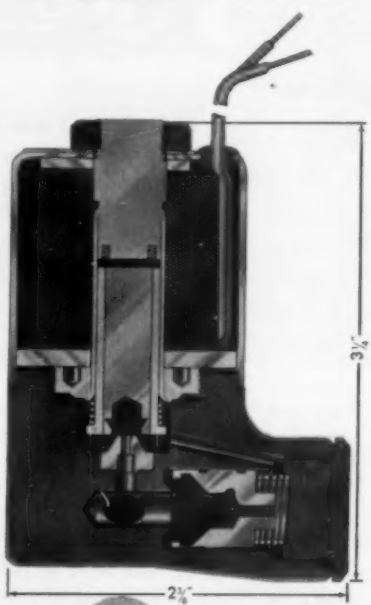
The temperature range of this new line is −65° to 180°F Ambient, and −65° to 150°F Media. It is light in weight—only 1¼ pounds—and can be mounted directly to the line by means of the ¼" NPT. Distance between ports is 2 inches.

* * *

For complete information about this new line of Skinner valves, please contact our Representative or Distributor near you—you'll find him listed in the Yellow Pages. Or write us at the address below, Dept. 313.

CONSIDER THESE OUTSTANDING FEATURES...

- Internal Parts—Stainless steel—give long, trouble-free service
- Coil—Continuous duty—10 watts max.—UL-approved
- Body—Forged brass—dense metal structure
- Mounting—Direct-line—can be serviced without removal from the line
- Options—Explosionproof, Manual Override, Electrical



SKINNER ELECTRIC VALVES

THE CREST OF QUALITY

SKINNER ELECTRIC VALVE DIVISION

NEW BRITAIN CONNECTICUT

105 EDGEWOOD AVENUE

... Fluid Power news

NEW 2,000 psi LONG-LIFE STEEL CYLINDERS

New Oilgear "Quality-Line" 2,000 psi Cylinders—for your tough jobs

Double-Acting Cylinders Designed for Continuous, Dependable, Long-Life Service

✓ Check these "Quality-Line" Cylinder Features:

✓ Dependable, Leak-Free, Long-Life Service Assured
Oilgear Cylinders still operating efficiently after 20 or more years in heavy-duty steel mill operations, presses, machine tools—cause equipment builders and users alike to claim—"For the lowest cost per year—it's Oilgear!" This reputation for reliability is the result of craftsmanship in every phase of proven, "gimmick-free" design and production that only four decades of experience can produce.

✓ Two Ram Sizes Available For Each Cylinder Bore Size
Standard or large—ground and polished rams have threaded ends and multiple wrench flats. Large rams provide exceptional rigidity and high return speeds.
Optional: alloy or hardened steel rams; chrome plating; special ram ends.

✓ Rugged, Shock-Resisting, "Hot-Rolled," Bar Steel Heads
Accurately machined and gauged for concentricity with cylinder bore and ram. New design saves space. Extra-large machined passages and pipe-tap-ports reduce fluid velocities, turbulence, and pressure loss. Straight or special tapped ports available.

✓ Confined, Preloaded, Super-"O" Cylinder Seals
Insure permanently leak-free, static and pressure seals between cylinders and heads.

✓ Heavy-walled, Seamless Steel Cylinders Precision Bored, Honed, and Polished
Carefully gauged for roundness, straightness, size—minimizes friction, slip, and wear.

✓ Simplified, Rotatable Head Mountings
Split, alloy-steel keeper rings and steel flanges allow heads to be rotated to any degree for mounting . . . re-positioned, or removed for inspection independently.

✓ Short, Recessed, Steel Tie Bolts
Eliminate long, sagging tie bolts, axial compression load on cylinders, distortion, stretching, exposed threads and nuts . . . permit individual head removal.

✓ Pistons Accurately Machined Concentric With Ram

✓ Four Precision-Fitted, Automotive-type Piston Rings
Effective sealing, exceptionally long life under severe, high temperature service.

✓ Molded, "V"-Type, Preloaded Ram Packing
Positive sealing action with uniform low friction characteristics. Face-mounted gland prevents excessive tightening and binding on ram.

✓ Large Area, Bushing Bronze Ram Guide

✓ Molded, Non-abrasive, Unit-Seal Ram Wiper
Has low friction coefficient—effectively removes dirt or abrasive material to prevent scoring ram, packing and guide wear, or infiltration into system. Maintains a sharp edge to uniformly clean the ram on every cycle.

✓ Exclusive, Self-Aligning, Adjustable Hydraulic Cushions
Available in front, rear, or both heads to eliminate shock, piston scoring, rapid wear, and check valves . . . an exclusive Oilgear design.

✓ Custom Application-Engineering Service
Given specific information, Oilgear Application-Engineers can recommend the best cylinder for your application. Oilgear will also custom-design and produce cylinders and complete Fluid Power Systems to exactly match your Controlled Motion requirements.

Call your local factory-trained, Oilgear Application-Engineer. Or write, giving specific information directly to

THE OILGEAR COMPANY

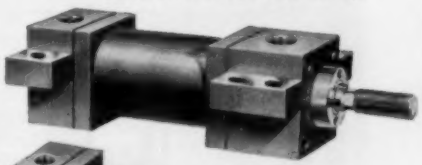
Application-Engineered Fluid Power Systems

1564 WEST PIERCE STREET • MILWAUKEE 4, WISCONSIN

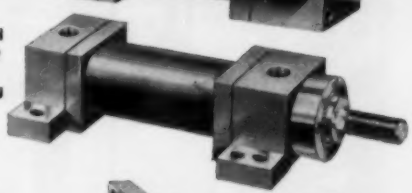
STANDARD MOUNTINGS

Heads can be combined, interchanged—rotated or removed independently.

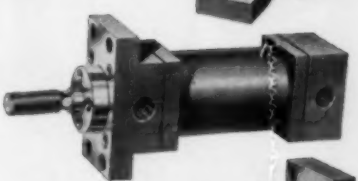
Front and rear Center Lug Mounting



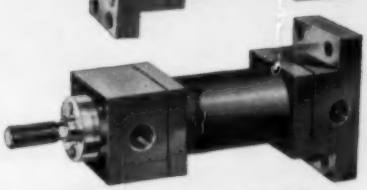
Front and rear Foot Lug Mounting



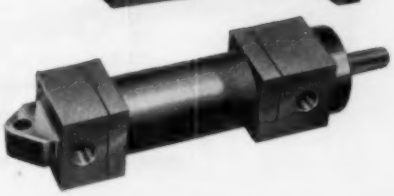
Front Flange Head Mounting



Rear Flange Head Mounting



Clevis Mounting and Plain Front Head



SIZES

Bore Diameter (i.d.)		2"	2½"	3¼"	4"	5"	6"	7"	8"
Standard Ram	Ram Diam.	1"	1"	1¼"	1½"	2"	2½"	2¾"	3"
	Max. Stroke	55"	60"	60"	65"	85"	95"	105"	110"
Large Ram	Ram Diam.	1½"	1¾"	2¼"	2¾"	3½"	4¼"	5"	5½"
	Max. Stroke	80"	87"	95"	105"	125"	140"	155"	160"

Longer Stroke Cylinders Available On Request

4 Oilgear Cylinder Bulletins Available On Request

No. 71000—2,000 psi Standard Cylinders

No. 73000—3,500 psi Heavy-Duty Cylinders Lug and Flange Mounted

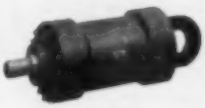
No. 73245—3,500 psi Heavy-Duty Cylinders Hollow-Trunnion Mounted

No. 79000—Heavy-Duty, Custom-Built Cylinders

NEED A CYLINDER?

Ledeen Stocks Them or Builds Them to Fit Almost Any Application

Hydraulic Press Cylinder


Military Cylinder

Miniature Cylinder

Shock Absorber Cylinder

Steel Mill Cylinder

Double Extended Cylinder

Roll Balance Cylinder

Chute Gate Cylinder

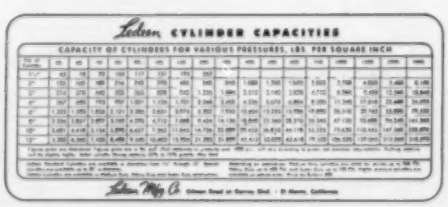
Air-Hydraulic Cylinder

Standard Ledeen Heavy-Duty Cylinder

Standard Ledeen Medium-Duty Cylinder

For normal applications requiring standard cylinders or for those unusual applications where a special cylinder is needed, see Ledeen.

Let us know the type of job to be done and how much cylinder power you need. Send for this handy cylinder capacity chart.


Ledeen CYLINDER CAPACITIES
CAPACITY OF CYLINDERS FOR VARIOUS PRESSURES, LBS. PER SQUARE INCH

Write for Bulletin 500

VALVES • CYLINDERS
VALVE ACTUATORS
AIR-HYDRAULIC PUMPS
AND TEST STANDS

Ledeen Mfg. Co.
3332 North Gilman Road
El Monte, California

FUTURE EVENTS

March 25-28: Packaging Machinery and Materials Exposition, Convention Hall, Atlantic City, N. J.

March 31-April 2: SAE Production Meeting and Forum. The Drake, Chicago, Illinois.

April 8-11: SAE Aeronautic Meeting, Aeronautic Production Forum, and Aircraft Engineering Display. Hotel Commodore, New York, N. Y.

April 14-17: Design Engineering Show, International Amphitheatre, Chicago. Write Clapp & Poliak, 341 Madison Ave., New York 17, for further details.

May 1-8: ASTE Tool Show, Convention Center, Philadelphia, Pa. For complete information write ASTE, 10700 Puritan Ave., Detroit 38, Mich.

May 14-15: First European Fluid Power Conference, St. Ermins Hotel, London S. W. 1, England. For complete details write to Compressed Air and Hydraulics, Temple Chambers, Temple Ave., London E. C. 4, England.

June 2-4: National Fluid Power Association Annual Spring Meeting, Bedford Springs Hotel, Bedford, Pa.

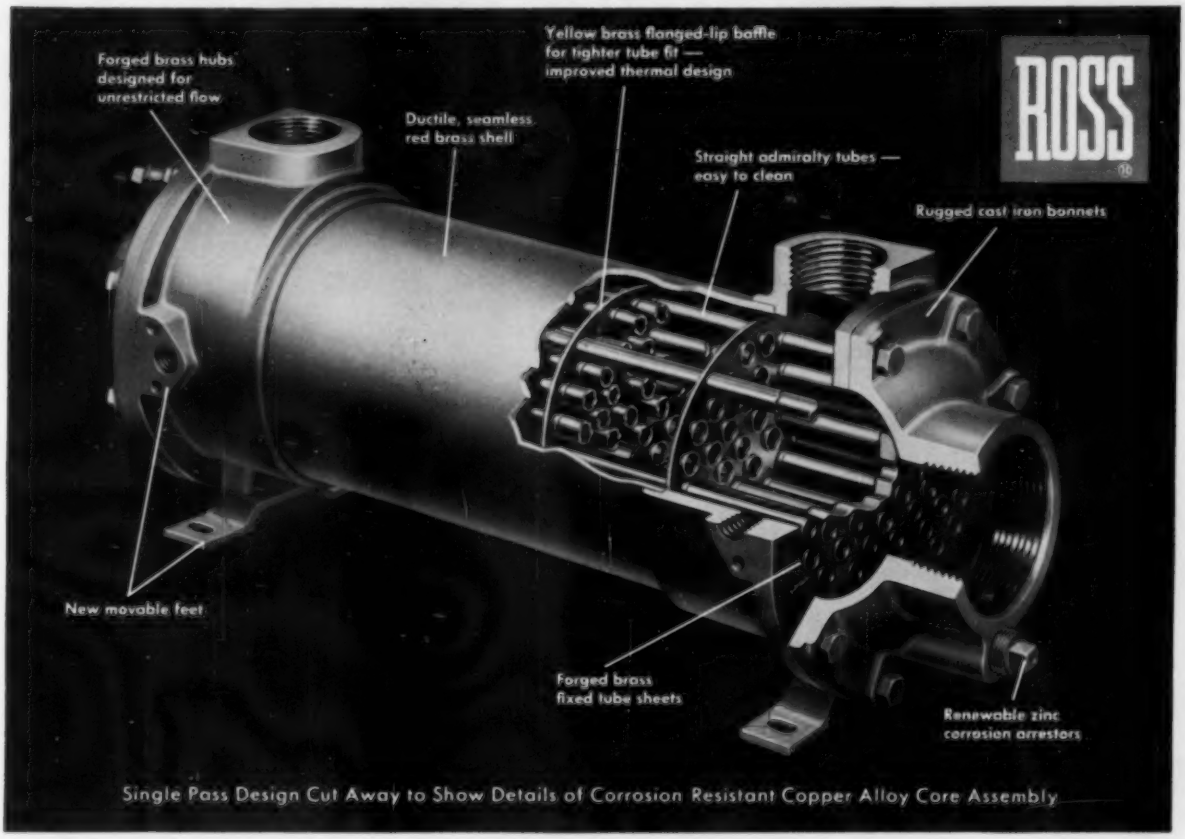
June 9-12: American Society of Mechanical Engineers national conference on materials handling. Public Auditorium, Cleveland, Ohio.

September 29-October 3: ASTE Semi-Annual Meeting and Western Tool Show. Shrine Exposition Hall, Los Angeles, Calif.

October 16-17: NCIH 14th Annual Meeting. Sherman Hotel, Chicago, Ill. For complete information write Raymond D. Meade, Conference Secretary, Illinois Institute of Technology, Chicago, Ill. ▼▼▼

LOOK AT THE LEADER'S LATEST . . .

'58 design of a famous line . . . Ross BCF Exchangers


Forged brass hubs designed for unrestricted flow
Yellow brass flanged-lip baffle for tighter tube fit — improved thermal design
ROSS
Ductile, seamless red brass shell
Straight admiralty tubes — easy to clean
Rugged cast iron bonnets
New movable feet
Forged brass fixed tube sheets
Renewable zinc corrosion arrestors

Single Pass Design Cut Away to Show Details of Corrosion Resistant Copper Alloy Core Assembly

LOOK AT THE LIST . . . new design features, new sizes, new capacities, new mountings, new materials . . . *new low prices!* In 1958 the leader and originator of small, compact, fully standardized exchangers takes another step forward.

The Ross Heat Exchanger Division of American-Standard originated the whole BCF idea 14 years ago. Before then, pre-engineered design, mass produced parts and stocked assemblies were untried for a unit of this type. Designers and users of original equipment were quick to adopt the BCF as standard. Today, on a larger scale than ever, it is cooling lube oil, jacket water, hydraulic and other fluids for a wide variety of industries.

But, even with such success, the BCF has never been permitted to stand still. Ross has persisted in making constant design refinements and performance improvements . . . *1958 is typical: New* baffles with flanged lip at each tube hole and around outer edge for tighter fit and improved thermal characteristics. *New* stamped steel feet, movable in three positions around hubs for easy, more adaptable mounting. *New sizes* and capacities . . . 46 models . . . one, two or four pass designs . . . giving greater selection than ever before.

Look at the leader's latest. Send in the coupon below for the new Ross Bulletin . . . an up-to-date run down on the 1958 Ross Type BCF Exchanger.

Mail this coupon for new Ross Bulletin

To: **American-Standard,** AH
Ross Heat Exchanger Division
Buffalo 5, N. Y.

Please send, without obligation, your new Bulletin 1.1K6 describing the 1958 Ross Type BCF Heat Exchanger.

NAME _____

TITLE _____

COMPANY _____

ADDRESS _____

CITY _____ ZONE _____ STATE _____

AMERICAN-Standard PRODUCTS

AMERICAN-Standard

ROSS HEAT EXCHANGER DIVISION

New CFC Honan-Crane Hydraulic Filter Meets JIC Specifications

Now, in this compact K-Type Filter, you are assured of continuous micro-clarity of all hydraulic fluids — for abrasive contaminants only, or for both solid and dissolved impurities. It's easy and economical to keep hydraulic fluids clean — avoid downtime, prevent excessive wear, safeguard against clogged valves and pistons.

NEW FLO-PAC

Filters Out 98% of All Particles Over 5 Micron.

The new FLO-PAC 5 Cartridge is designed to remove 98% of all particles larger than 5 microns. Tough, resin-impregnated pleated paper provides more than 6300 square inches of filtering surface. Paper is inert — will not remove additives. FLO-PAC 5 is especially designed for high flow-rates; for either full-flow or by-pass filtration; and for water-base hydraulic fluids.

"T" TYPE CRANITE

for Solid Particles and Products of Oxidation

The new K-Type Cartridge was developed specifically to best meet JIC hydraulic standards. It contains 13 pounds of Type "T" Cranite (fuller's earth) enclosed in a metal container. It removes water, acids, tars, and asphaltines as well as solid contaminants. Processed at extremely high temperatures, Type "T" Cranite is especially resistant to water. Cranite is packed so solidly that it cannot settle, thereby preventing by-passing. This new K-Type Cartridge is interchangeable in many makes of filters which meet JIC Specifications.

For technical literature, write today to Department AH.

COMMERCIAL FILTERS CORPORATION
MELROSE 76, MASSACHUSETTS
PLANTS IN MELROSE, MASSACHUSETTS AND LEBANON, INDIANA

Fulflo FILTERS — *with genuine Honeycomb Filter Tubes for controlled micro-clarity of industrial fluids.*

CFC FILTERS — *Selective filtration of oils • water-oil separators • magnetic separators • pre-coat filters • coolant clarifiers • automatic tubular conveyors.*

MICRO-CLARITY AT MINIMUM COST

NOW • Added Service Life for the Accepted Leader Among Heavy Duty Fluid Power Pumps

HYDRECO

Series 3000 FLUID POWER PUMPS

3000 SERIES
1500 psi
57 to 97 gpm at 1800 rpm

MAIN SHAFT BEARINGS
Large, heavy-duty, anti-friction roller bearings have more than adequate capacity to carry full pressure loads at high speeds.

THRUST BEARINGS
Carry axial load of the drive shaft.

DOUBLE LIP SEAL
Protects high pressure seal and keeps dirt out of the pump.

HIGH PRESSURE ROTARY SEAL
Eliminates pressure bleed back, keeps pump efficiency high.

PRESSURE-BALANCED WEAR PLATES
Balanced, hydraulic forces on both sides of the plates accurately maintain fixed clearances between the plates and the gear faces . . . high volumetric efficiencies are assured at all pressures and power-robbing, frictional contacts eliminated.

APPLICATIONS

EARTH MOVING EQUIPMENT
CONSTRUCTION MACHINERY
MATERIALS HANDLING EQUIPMENT
AGRICULTURAL MACHINERY
MOBILE and GENERAL
INDUSTRIAL EQUIPMENT

Member NFPA

The basic design of HYDRECO Fluid Power Pumps has been proven in thousands of successful installations . . . on Earth Moving, Materials Handling and Agricultural equipment . . . where dependability, efficiency and ruggedness are of prime consideration. *Now,* this famous design has been refined by improvements that give you this outstanding performance PLUS – *substantially extended service life – three times greater!* Translated in terms of dollars and cents, this greater service life adds value to the Pumps you buy and pays your customers extra dividends on their investment.

Check the features shown above... combined, they enable HYDRECO Series 3000 Pumps to set new standards in performance, efficiency and trouble-free service.

Write –

for performance and installation data on HYDRECO 3000 Series Fluid Power Pumps.

Kalamazoo Division
The New York Air Brake Company
9004-3 East Michigan
Kalamazoo, Mich.

Please send me complete information on HYDRECO Series 3000 Pumps.

Name_____

Company_____

Address_____

City_____ Zone____ State_____

THE NEW YORK AIR BRAKE COMPANY

KALAMAZOO DIVISION • KALAMAZOO, MICHIGAN

CIRCLE 68 ON READER SERVICE CARD

NEW TESTS HIGHLIGHT ASSETS OF LEATHER PACKINGS

- **Flesh Side Out — lower friction regardless of impregnation**
- **Flesh Side Out — lower porosity regardless of impregnation**
- **Rubber Impregnation — lower friction than hard wax**
- **Rubber Impregnation — less leakage than hard wax**
- **Uniquely Designed Houghton 1243-3 Cups — superior to all other types**

DESIGNERS AND MAINTENANCE MEN both are interested in modern leather packings. Their resistance to abrasion and extrusion, their compatibility with modern fire-resistant hydraulic fluids, and their strength under high operating pressures spell long, trouble-free service and makes them ideal seals under many combinations of process conditions.

In response to the demand for further technical data on friction and porosity benefits from leather packings, Houghton engineers recently completed a comprehensive study of the conventional leather cup packings used in industry today. The findings are headlined above.

TEST RESULTS

Synthetic Rubber—(Houghton 1243-3) flesh out, flared wall, square shoulder

No. of Cycles	Friction Push	Friction Pull	Test Pressure	Pressure Increased To	Oil Loss Milliliters	Strokes Per Minute	Average Cylinder Temp.
500	20 lbs	0 lbs	500 psi			30	80°F
	25 lbs	0 lbs		1,000 psi		15	
700	25 lbs	10 lbs	1,000 psi			30	82°F
	25 lbs	10 lbs		2,000 psi		15	
900	40 lbs	10 lbs	2,000 psi		no measurable loss	30	83°F
	40 lbs	10 lbs		3,000 psi		15	
1,100	60 lbs	25 lbs	3,000 psi			30	84°F
	60 lbs	25 lbs		4,000 psi		15	
1,300	75 lbs	40 lbs	4,000 psi			30	85°F
	75 lbs	40 lbs				15	

Wax—Grain out, straight wall, round shoulder

No. of Cycles	Friction Push	Friction Pull	Test Pressure	Pressure Increased To	Oil Loss Milliliters	Strokes Per Minute	Average Cylinder Temp.
500	125 lbs	175 lbs	500 psi		32	30	80°F
	150 lbs	225 lbs		1,000 psi		15	
700	150 lbs	225 lbs	1,000 psi		38	30	100°F
	175 lbs	250 lbs		2,000 psi		15	
900	175 lbs	250 lbs	2,000 psi		40	30	105°F
	200 lbs	300 lbs		3,000 psi		15	
1,100	200 lbs	250 lbs	3,000 psi		41	30	110°F
	275 lbs	325 lbs		4,000 psi		15	
1,300	250 lbs	275 lbs	4,000 psi		42	30	115°F
	275 lbs	325 lbs				15	

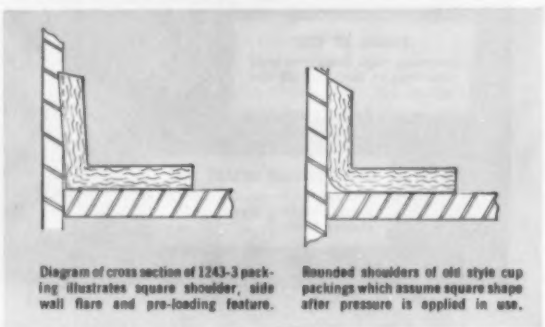


Diagram of cross section of 1243-3 packing illustrates square shoulder, side wall flare and pre-loading feature.

Rounded shoulders of old style cup packings which assume square shape after pressure is applied in use.

THE PACKINGS TESTED... included both wax and rubber impregnated types with round and square shoulder, flared and straight wall, and with flesh side and grain (hair) side of the leather as the contacting surface. In order to achieve equality in test conditions, all cups were identically spring-loaded when mounted.

JUSTICE MACHINE TESTING... The cups were driven for various numbers of cycles under different oil pressures in our Justice machine. In such tests highly accurate measurements of surface finish and power loss due to friction are made. A comparison of typical test results is shown at the left. Complete results are available on request.

FLESH-OUT THEORY... The porosity results substantiated a long-standing theory on the superior performance of leather packings moulded with the

flesh side out. According to this theory, moulding the flesh side out minimizes leakage because the tightly knitted grain surface is next to the pressure and does not wear away in service.

TOP PERFORMANCE OF 1243-3 CUP... The tests also reaffirmed the superior performance characteristics of Houghton's 1243-3 leather cup impregnated with synthetic rubber. The unique impregnation developed by Houghton researchers is much more than a surface coating. The liquid rubber polymer is actually channeled down among the fibers of the leather for a complete permanent impregnation which imparts the sealing qualities and pliability of rubber to the strong wear-resistant leather packings.

Houghton's unique synthetic rubber impregnation gives this 1243-3 leather cup the pliability and sealability of rubber.

ENGINEERING NEVER STOPS. The recommendations of a Houghton packing engineer are always based on facts obtained through tests like this leather packing study. Houghton developments include standard stack heights for "V" packings (making possible the interchangeability of packings of various materials without redesign of the gland). The pre-forming of square shoulders, and the spring mounting technique described above are Houghton developments. Houghton engineering has contributed to better packing materials, simplification of hydraulic systems engineering, more efficient hydraulic fluids.

When you specify Houghton packings you'll find on-time delivery and prompt service as much a part of our program as sound engineering. Check the full line at the right. Pick the packings you need and contact the Houghton Man or write for engineering data. Specific folders on each type are available. Write E. F. Houghton & Company, 303 West Lehigh Ave., Philadelphia 33, Pennsylvania.

HOUGHTON PACKINGS FOR HYDRAULIC AND PNEUMATIC SYSTEMS

"VIM" LEATHER PACKINGS

Over 140 combinations of leathers and impregnations have been developed by Houghton's research department, to fit nearly all conditions. They provide efficient seals against oil, brine, water, oxygen, phosphate esters and other mediums.

Cups, flange, "U", "V"—flat washers, discs and gaskets—for oil, air, water or gas applications—engineered for smoother, more positive sealing action at all pressures and temperatures up to 160°F.

"VIM" No. 1243-3 RUBBER-IMPREGNATED LEATHER PACKINGS

Our most recent packing development is the complete impregnation of leather packings with synthetic rubber. Thorough impregnation combines the durable strength of leather with the non-porosity and resilience of rubber—easy to install, excellent sealing and less friction at low and high pressures.

"VIX-SYN" SYNTHETIC RUBBER PACKINGS, O-RINGS

Our special moulding process results in a more compact structure, and more uniform density. Line includes homogeneous and fabricated packings, gaskets, O-rings—and "Vim" leather back-up washers designed for use with Vix-Syn O-rings.

GET THESE HANDBOOKS DESCRIBING HOUGHTON PACKINGS AND ENGINEERING SERVICE

1. "Handbook on Leather Packings" includes complete data on hydraulic and pneumatic applications.
2. "Handbook on Synthetic Rubber Packings" provides valuable information for design engineers.
3. "Packing Standards"—Houghton's latest edition accepted as the standard handbook on leather and synthetic rubber packings for hydraulic and pneumatic applications.

A COMPLETE FAMILY OF FLUIDS, TOO

"HYDRO-DRIVE" PETROLEUM BASE HYDRAULIC OIL

Houghton's high quality hydraulic oil is fortified for maximum efficiency.

"HOUGHTO-SAFE" FIRE-RESISTANT HYDRAULIC FLUIDS

Water-base and Phosphate Ester types.

HYDROLUBRIC F.R.

Emulsion type fluid.

"HYDROLUBRIC" ADDITIVE FOR WATER

For closed water hydraulic systems.

PACKINGS

... products of

E. F. HOUGHTON & CO.

PHILADELPHIA · CHICAGO · DETROIT · SAN FRANCISCO

Ready to give you on-the-job service...

SECO
ISO-FLO
PUMP

Advantages

- Several *isolated* flow outputs from one pump.
- Separate pressure control of these several outputs is accomplished without complex flow control or reducing valves.
- High flow, low pressure . . . and low flow, high pressure from one pump.
- Ideal for accumulator circuits . . . Does not require delicate and unpredictable automatic unloader valve . . . Eliminates constant cycling.
- Automatic unloading characteristics permit large savings in horsepower, and greatly prolonged bearing life.
- ISO-FLO pumps will accomplish most cut-back or clamping operations better than a variable displacement pump—and at lower cost.
- Ideal for parallel feed of cylinders.
- Output of one piston may be used to control the function or cycling of remaining pistons.
- Great flexibility of flow rates is obtainable simply by adding or removing pistons.

Available in models with 7 or 14 pistons. Capacities ½ to 10 G.P.M. Operating pressures over the entire 0 to 10,000 PSI Range.

SECO

SIMPLEX ENGINEERING CO.
Subsidiary of RACINE HYDRAULICS & MACHINERY, INC.
ZANESVILLE, OHIO

LETTERS
to the editor

Address your letters to: Editor, APPLIED HYDRAULICS MAGAZINE, 812 Huron Rd., Cleveland 15, Ohio.

Hydraulics Training

The Ohio Trade and Industrial Instructional Materials Laboratory is working with a statewide committee in the preparation of an elementary manual on hydraulic maintenance. Can we get copies of your Fluid Power Circuits (published January 1954) to include in this manual? First printing will probably be 1000 copies.

MERLE E. STRONG
Ohio State University
Columbus, Ohio

Copies of this booklet are not available. A new printing can be ordered in quantities of 1000 *or more.*

Spool Valve Leakage

Re: Understanding Spool Valves—Nov. 1957

I would disagree with the author's view that leakage rates of 40 to 150 cc/min are required to keep the valve wet. General experience has shown that such valves operate satisfactorily with leakage rates of the order of one drip every few minutes provided there is adequate filtration. I would suggest that the leakage rates quoted by the author are required to carry away silt which is in the system and which is due to insufficient filtration.

In addition to the above I feel the author has not paid enough attention to fundamental considerations when he states "A dead band, although small, exists at the valve center, and a small portion of the valve movement each side of the true neutral will occur with no change in pressure at the cylinder ports". The valve shown in the figure (dimensions have been exaggerated) has overlap but the notches have been neglected for they are irrelevant to the argument. When the valve is centered, provided $L_1 \approx L_2$ and $L_3 \approx L_4$, the pressures at the cylinder channel

Continued on page 22

ONLY Eastman

CAN GIVE YOU THIS COMBINATION . . .

EXCLUSIVE EASTMAN PACKAGE

Exclusive Eastman Inter-Lock® Clamp for Best Hose Connection.

Exclusive grip advantages offered in no other clamp. Accurate machining assures positive positioning. Hose is uniformly compressed between insert and clamp without pinching or weakening, creating Eastman's exclusive "Inter-Lock" grip.

Eastman Split Flange for Tighter Seal at Higher Pressures.

Cuts production and replacement costs with a No-Thread, No-Leak "O" Ring Connection which eliminates tapered threads, sealing compounds and spiral leaks—as well as housing distortion.

Only Eastman can give you this Split Flange Clamp and exclusive Inter-Lock Coupling Combination. *Only* when you specify Eastman can you get the advantages of both. *Only* Eastman can give you this convenient one-source package.

This combination is ideal for *Original* heavy duty equipment. It is the only answer to high pressure requirements because it meets highest OEM specifications and easy field replacement needs.

Available with stem inserts in angles from 0° thru 90°, sizes from ¼" thru 2", recommended pressures from 375 p.s.i. to 5000 p.s.i.

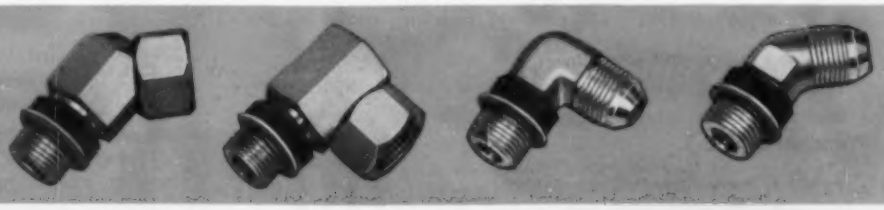
Look to Eastman . . . America's No. 1 OEM specification . . . for all your fluid power line requirements . . . for the best assembly, the best performance, the best service. Eastman is also recognized for its leadership in engineering design and development . . . backed by unequalled years of experience in the field. *It pays to submit your original specifications for your first quotation to Eastman!*

EASTMAN SPLIT FLANGE

Eastmon offers you the famous patented split flange design which assures a tilt and blowout proof clamp. "The higher the pressure the tighter the 'O' Ring seal."

Eastman "O" Ring Boss Fittings

Now available with new "Back-up" washer and locknut eliminating "O" Ring extrusion per SAE specifications.



Eastman
first in the field

Manufacturing Company
Dept. AH-3
Manitowoc, Wis.

DESIGN AND DEVELOPMENT ENGINEERS:

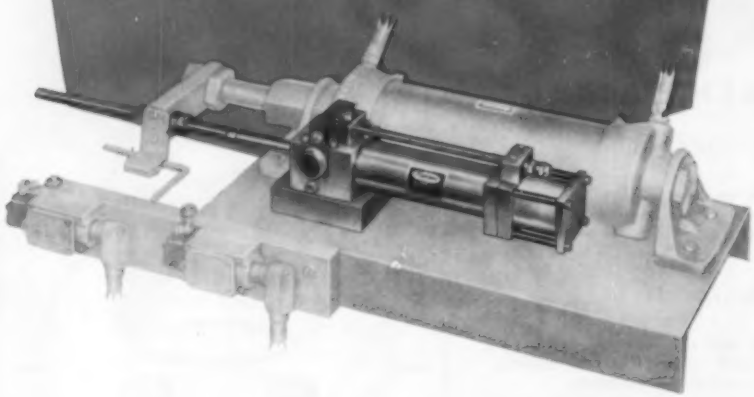
Write for Technical Bulletin 200 for Information and Specifications on Complete Eastman Line of Hydraulic Hose Assemblies, and Bulletin 40 on Inter-Lock clamp.

Now—Hydraulic Smoothness and Control from your own Air Cylinder plus a

VERI-TROL

TRADE MARK

Hydraulic Checking Cylinder



Designed for use with conventional air cylinders, VERI-TROL hydraulic checking cylinders smooth out stroke variations due to the compressibility of air under irregular load conditions. They're ideally suited for use with air cylinders operating tool or work-piece feeds, precise positioning devices, or wherever you need a smooth, uniform work stroke at any desired pre-set speed. VERI-TROL features (patents applied for) include:

- ACCURATE SPEED CONTROL is dial-set, load-compensated to assure uniform stroke speed even with irregular loads.
- BUILT IN "SKIP," "STOP" OR "SKIP-STOP" controls optional.
- VISIBLE OIL RESERVOIR, easy to refill.
- 2,000 LB. CHECKING CAPACITY on out stroke, free return.
- 2", 4", 6", 9", 12", 15" and 18" checking stroke lengths.

Take the bumps and jumps out of air cylinder operation—install VERI-TROL checking cylinders wherever you want smooth, accurately-controlled stroke speed. Write now for free data bulletin; please address Dept. B-3.

Modernair CORPORATION

400 PREDA ST., Dept. B-3

SAN LEANDRO, CALIF.

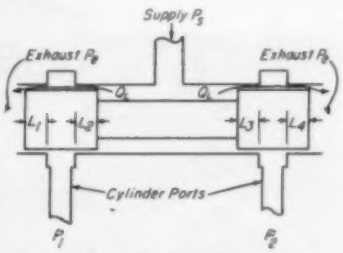
36

MEMBER OF NATIONAL FLUID POWER ASSOCIATION

CIRCLE 88 ON READER SERVICE CARD

LETTERS

ports will be, as the author states, about one half of the supply pressure.



The flow through an annular clearance of finite length is proportional to the pressure gradient, thus

$$Q_L \propto \frac{P_s - P_1}{L_2} = \frac{P_1 - P_e}{L_1}$$

From which we obtain that

$$P_1 = P_s - \frac{L_2(P_s - P_e)}{L_1 + L_2}$$

and similarly

$$P_2 = P_s - \frac{L_3(P_s - P_e)}{L_3 + L_4}$$

However, directly the valve is moved off center but before any true valve opening occurs the pressure on one side of the cylinder will rise and that on the other will fall. This is brought about by the copious leakage mentioned above and the changes in the amount of lap on either side of each port (note equations for P_1 and P_2). It is in direct contradiction with the author's view but is backed by theory as well as experimental results.

I feel that to avoid any "fallacious understanding" of these valves some correction to the article might be made.

D. E. TURNBULL
British Hydromechanics
Research Laboratory
Essex, England

Mr. Turnbull's theories are fair. I feel however, that the valve he describes would make a very good bung. In aircraft control systems especially it is very necessary to avoid sticking, from any cause, silt, deflection, heat, cold, self-made bricabrac, etc. Enlightened engineers should provide for copious leakage and more frequent cycling.

It is interesting to note the

Continued on page 24

Fastest in-the-field replacement!

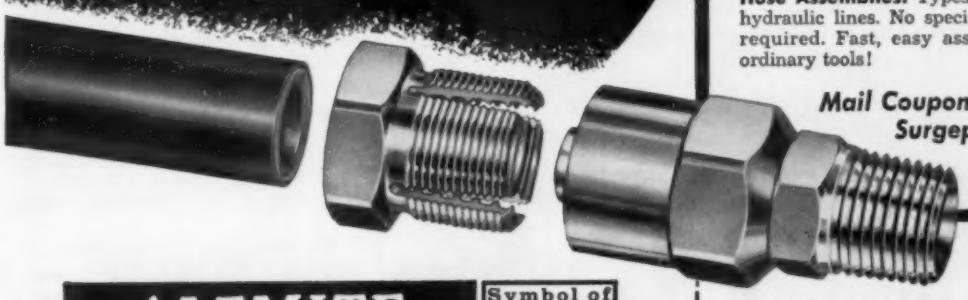
First choice for original equipment!

The Complete Line of

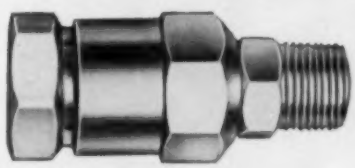
ALEMITE SURGEPRUF

REUSABLE COUPLINGS AND HYDRAULIC HOSE

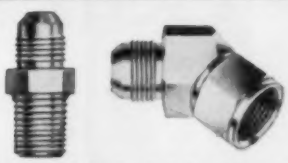
...with a full line of components nationally available!



Single- and Double-Wire Hose For Medium-High Pressure and High-Pressure Service. Seamless inner tube of synthetic rubber, reinforced steel wire braid, and synthetic rubber outer cover. Resists abrasion, weather, and oil. Hose temperature operating range: —40° F. to +275° F.



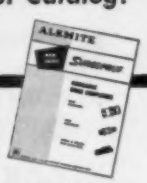
Couplings. Made of high-strength steel. "Double-wedge grip" forces coupling threads through rubber cover . . . grips either single- or double-wire braid firmly. Saves both time and labor!



Adapters and Swivel Adapters. Full range of sizes in J.I.C. and other threads. One-piece adapters—and swivel union adapters to simplify assembly and avoid twisting strain in cramped quarters.

Hose Assemblies. Types and sizes for all hydraulic lines. No special assembly tools required. Fast, easy assembly with just ordinary tools!

Mail Coupon for Surgepruf Catalog!



ALEMITE, Dept. EE-38
1850 Diversey Parkway, Chicago 14, Illinois

Please send me your catalogs of Surgepruf couplings, hose and components.

Name .....

Company .....

Address .....

City ..... Zone ..... State .....

ALEMITE
DIVISION
STEWART-WARNER
CORPORATION

Symbol of **SW** Excellence

1850 Diversey Parkway, Chicago 14, Illinois

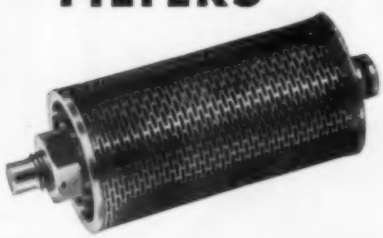
Advanced Filtration

CUNO **PORO-KLEAN**

MAGNETIC

FILTERS

LINE TYPE
MAGNETIC FILTER HOUSING
AND TYPICAL CARTRIDGE



- **FINE FILTRATION** 5 microns
- **HIGH TENSILE STRENGTH** 15,000 p.s.i.
- **HIGH HEAT RESISTANCE** 900° F.
- **NO PARTICLE DISCHARGE**
- **STAINLESS STEEL CONSTRUCTION**
- **MAGNETIC CONSTRUCTION** 1 micron retention

All the advanced filtration characteristics to meet the specifications you are looking for, with *Micronic-Mechanical* Filtration as fine as 5 microns and *Micronic-Magnetic* Filtration removing *sub-micronic* ferrous particles.

Available in either Line or In-Line type filters with various flow rates to meet your specifications.

WRITE NOW FOR FULLY DESCRIPTIVE LITERATURE . . . *Free Poro-Klean Bulletins will be sent to you by return mail.*

A COMPLETE APPLICATION ENGINEERING SERVICE
The Cuno Field Engineer in your area can help you select the right filter to solve your hydraulic filtration problems.

CUNO ENGINEERING CORPORATION
203 SOUTH VINE STREET, MERIDEN, CONN.
TELEPHONE: BEverly 7-5541
EDGE-TYPE, WIRE-WOUND, SCREEN, FIBER CARTRIDGE and POROUS METAL FILTERS

Filtration Engineers *In Principal Cities*

LETTERS

tendency in aircraft practice to encourage external leaks also, such as would "wet" moving shafts, for instance, and help avoid the hazards of corrosion. A leak is often more healthy than a dry part.

The "dead band" should probably be referred to the valve action in doing work, where a certain amount of pressure differential is needed to create movement; it is minute otherwise.

ROBERT SPURR, Functioneer
Canadair Limited
Montreal, Canada

January Guide Issue

Your January issue of APPLIED HYDRAULICS is one of the best issues of the year. In fact in my opinion it is the most interesting magazine in the field.

I want to compliment you on your wonderful work as I have heard many favorable comments on the fine articles that you print.

GEORGE E. CARLSON, President
Minnesota Rubber Co.
Minneapolis, Minn.

We have recently introduced a line of filter-regulator-lubricators. These products should have been included in the January Guide charts.

A. J. DUNN, Sales Manager
Gits Bros. Manufacturing Co.
Pneumatics Div.
Chicago, Ill.

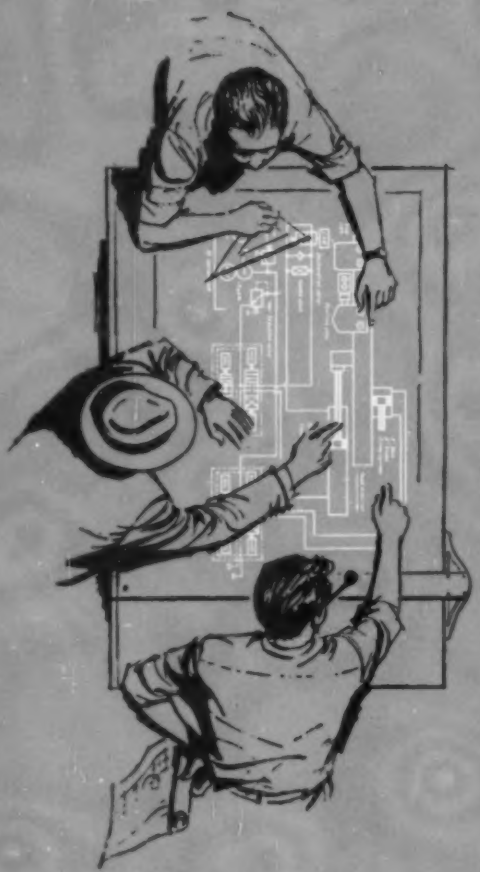
We wish to point out that you have omitted a number of our standard pressure gages including dial diameters of 2″ and 8½″; also types piston, manometer, and others.

R. J. INGHAM, Chief Engineer
Ashcroft Gages
Manning, Maxwell & Moore Inc.
Stratford, Conn.

We have your January issue of APPLIED HYDRAULICS and wish to compliment you on the very serviceable tabular presentation of components. However, we note some ommissions . . . our company isn't shown. We manufacture directional control valves for water hydraulic service.

ALBERT M. PATTERSON, President
Seely Instrument Co., Inc.
Niagara Falls, N. Y.

HYDRAULICS IN YOUR NEW DESIGN?



call the man from Webster

. . . and right at the start — before design problems pyramid costs and delay production. The man from Webster is a specially trained hydraulics engineer, armed with the latest technical know-how on hydraulic power application. He'll work with you, for you, to make hydraulics serve your product better. And, chances are, one of the more than 600 Webster pumps and fluid motors will be the key to successful, efficient operation.

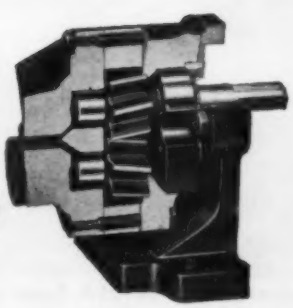
OIL HYDRAULICS DIVISION

WEBSTER ELECTRIC
MELROSE 3-3511
RACINE · WIS

MORE THAN 600 WEBSTER PUMPS AND FLUID MOTORS

Capacities: *1/5 to 30 GPM*
Pressures: *Up to 1500 PSI*
Speeds: *Up to 3600 RPM*
Drives: *Direct or Geared*
Torques: *Up to 60 in. lbs./100 PSI*
Available with or without built-in relief valves

H-108



☐ *Have THE MAN FROM WEBSTER contact us—*

- Please send the following -

☐ *Complete hydraulic catalog of pumps and valves*

☐ *New information or data as published*

Name _____
Title _____
Company _____
Street _____
City _____ State _____

CIRCLE 144 ON READER SERVICE CARD

ROCKRITE® TUBING—

"As Supplied"—
Ideal for cylinder applications

- costs less per finished pound—
- no processing of inside diameters—
- usable as supplied—
- overnight shipment from regional steel service centers—

ROCKRITE cylinder-finish, seamless tubing was developed expressly for cylinder application. Cold working by the ROCKRITE method imparts higher mechanical properties and exceptional machining qualities. Increased packing life will be obtained from ROCKRITE cylinder-finish tubing.

Stocked by leading steel service centers throughout the country. Immediately available in quantity in a complete range of standard sizes. Contact your leading tube distributor for one piece to a carload.

Write today for Bulletin R7A that describes ROCKRITE tubing.

ROCKRITE® TUBING

TUBE REDUCING CORPORATION

520 MAIN AVE., WALLINGTON, N. J.

Mailing address: P. O. Box 959A, Passaic, N. J.

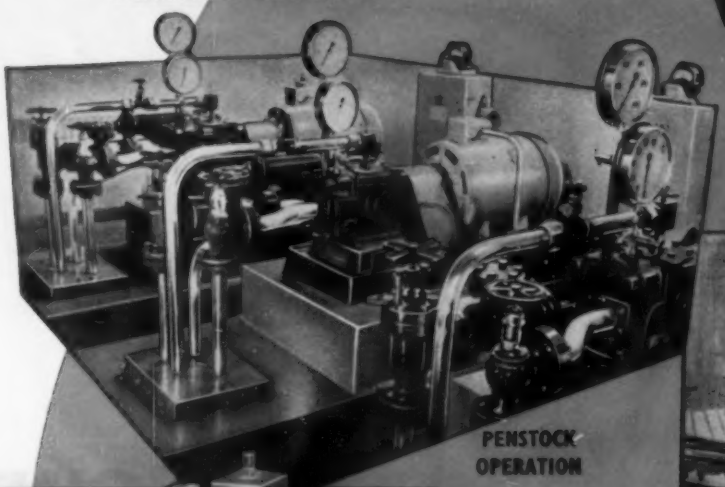
CIRCLE 149 ON READER SERVICE CARD

'VSG'

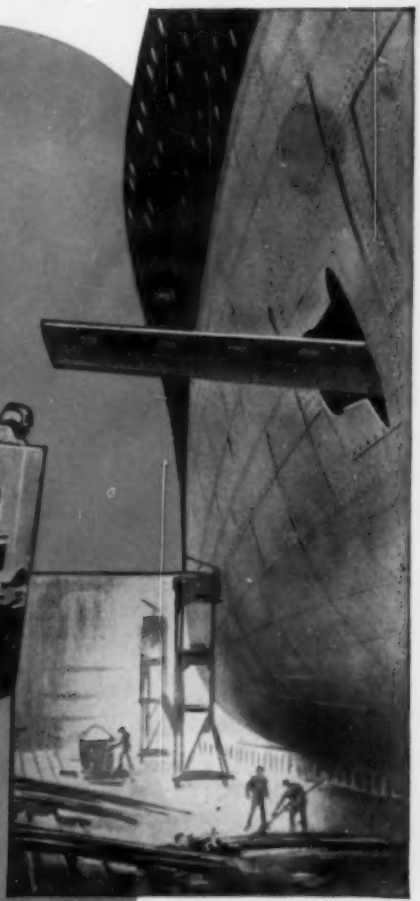
SERVING MODERN INDUSTRY

Regd Trade Mark

Infinitely VARIABLE HYDRAULIC TRANSMISSION GEARS AND PUMPS

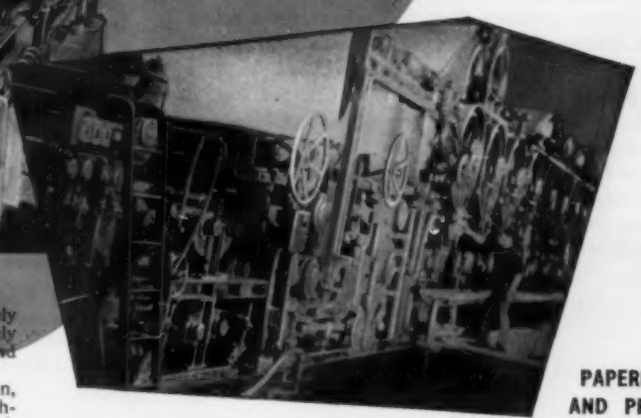


PENSTOCK OPERATION



SHIP'S STABILISERS & STEERING GEARS

TRAVERSER DRIVES



PAPERMAKING AND PRINTING MACHINE DRIVES

These are but a few of the many widely varied applications of 'VSG' Infinitely Variable Speed Transmission Gears and Delivery Pumps.
Precise speed control, smooth acceleration, high starting torque and remote push-button control are among the features which commend 'VSG' to industry the world over. Can 'VSG' solve your transmission problem?

VICKERS-ARMSTRONGS

Distributed in Canada through dealers by
BRANT-CANADIAN DISTRIBUTORS LTD.
Main Stocks are carried in Montreal and Vancouver

CONSOLIDATED ENGINEERS & MACHINE CO. LTD.
5645 Pare Street
Town of Mount Royal, P.Q.

BAWDEN INDUSTRIES LTD.
163-181 Sterling Road
Toronto 3, Ont.

GALBRAITH & SULLEY LTD.
1331 W. 6th Avenue,
Vancouver 9, B.C.

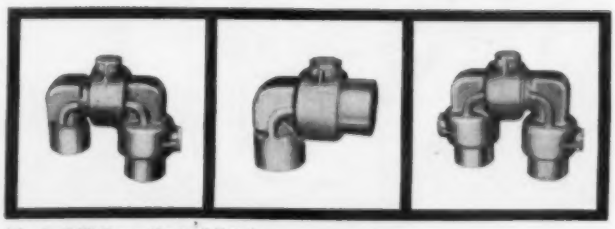
VICKERS-ARMSTRONGS (ENGINEERS) LTD · Vickers House · Broadway · London · England · Cables: Vickerseng London Telex
D26c

PROBLEM: TORSION FATIGUE ON RUBBER HOSE

SOLUTION: **CHIKSAN SWIVEL JOINTS**

When twisting and kinking on hose lines present a torsion fatigue problem, look to Chiksan for a ready solution. Chiksan Swivel Joints, with free turning 360° rotation allow hose lines to be flexed without the twist caused by fixed position fittings. With Chiksan Swivel Joints hose lines last longer, maintenance and down-time are virtually eliminated.

Call on Chiksan, depend on Chiksan. Over 1000 different types, styles and sizes have been developed for pressures from 28" vacuum to 15,000 psi and temperatures of −70° to +225°F. A nearby representative is ready to analyze your requirements and make specific recommendations. Write today for his name.



Typical Chiksan Swivel Joints

WRITE FOR DESCRIPTIVE CATALOG
Dept. 193

CHIKSAN

A SUBSIDIARY OF FOOD MACHINERY AND CHEMICAL CORPORATION fmc

CHIKSAN **CHIKSAN COMPANY**–BREA, CALIFORNIA • CHICAGO 5, ILLINOIS • NEWARK 2, NEW JERSEY

Well Equipment Mfg. Corp. (Division), Houston 1, Texas • Subsidiaries: Chiksan Export Company • Chiksan of Canada, Ltd.

NEW
from
DENISON

4-WAY VALVE

Pilot-operated, solenoid-controlled for hydraulic systems up to 3000 psi

SHOCKLESS CONTROL is assured with Denison's new line of 4-Way Valves for any directional control requirement.

Designed to provide directional control of oil flow up to 30 gpm—pressures up to 3000 psi, and all porting and positioning combinations—these new valves offer exceptional design versatility to Hydraulic Engineers because:

1. They meet all JIC requirements.
2. Over-all length is shorter than any other comparable valve.
3. Shortest solenoid power stroke increases operative force.
4. Special built-in check provides pilot pressure without adding another valve to the system.
5. No bulky, external chains to catch on equipment or personnel. Rugged, drawn-steel solenoid covers are secured to body with internal retaining cords.
6. Oil-enclosed solenoids are available.
7. Direct current operation also available.
8. Interchangeable parts simplify service and model changes in the field.

DESIGNERS ENGINEERS!

Send for Bulletins VD-7 and VD-8

for full details write

DENISON ENGINEERING DIVISION
American Brake Shoe Co.
1166 Dublin Road • Columbus 16, Ohio

HYDRAULIC PRESSES • PUMPS • MOTORS • CONTROLS

Denison and Denison HydrOILics are registered trademarks of Denison Eng. Div., ABSCO

DENISON HydrOILics

CIRCLE 39 ON READER SERVICE CARD

BRIEFS

about fluid power

JUDGES FOR 1958 FLUID POWER PRIZE PAPER CONTEST

George R. Keller

Clifford G. Menard

Morton M. Coker

The three prominent engineers who are judging the 1958 APPLIED HYDRAULICS *Prize Paper Contest represent long experience in applying fluid power to equipment in the aircraft, mobile equipment, and industrial fields. Each has made outstanding contributions based on advanced fluid power design, and is responsible for concepts leading to higher speed, better control, and greater efficiency.*

• **GEORGE R. KELLER**—Group Leader in the Flight Control Engineering Department of Autonetics, A Division of North American Aviation, George Keller has also been very active in association work. In his present position, he is responsible for the design and development of hydraulic systems and power servomechanisms for controlling high performance aircraft and missiles.

A native of Connecticut with a Sc. B degree from Brown University, he has furthered his education with graduate work at UCLA. Before joining North American in 1950, Keller was a project engineer with Solar Aircraft and a research engineer with Convair. He is a member of the SAE Committee A-6 on hydraulic and pneumatic systems, and is also a member of the A-6C Subcommittee on hydraulic pumps and motors. His additional activities in SAE include chairmanship of the A-6A Subcommittee on hydraulic system materials. He is a civilian consultant to the Office of the Assistant Secretary of Defense (R&E) in the working group on hydraulic fluids and lubricating oils.

Keller has had a number of papers and articles published. These cover hydraulic components as well as system design. Many discuss his specialty of high temperature hydraulics. He is the author of the recent book, *Aircraft Hydraulic Design.*

• **CLIFFORD G. MENARD**—In his present position as Chief Engineer of the Grinding Engineering Div. of the Heald Machine Co., Clifford Menard is qualified by many years of experience in developing boring machines and internal grinding machines. Because fluid power has become a primary part of these machines, hydraulics has been an important area of his activities.

He has met requirements of his machines by developing new components, including a combination relief and unloading valve. This permits using pressures of 100 to 150 psi and consequently large oil volumes which can be accurately controlled.

Mr. Menard has done important work in reservoir design, and has eliminated suction filters by proper baffling. He has developed double walled reservoirs to dissipate heat. These maintain temperatures of about 100 F.

He has also done development work in speed control and has developed special orifices which maintain accurate flow under varying temperatures.

Continued on page 32

Sirvene solves blade problem for Hypro

Sirvene impeller blades bend 90° at 1750 r.p.m.

– but never break, never take a "set"

Hypro Engineering, manufacturer of pumps for farm, home and industrial use, needed a better transfer pump impeller. When they came to C/R Sirvene they asked, "Can *you* compound and mold an impeller that will tolerate extreme blade deflection 1750 times a minute and resist 'setting' during long inoperative periods, and still meet our standards for service life?" Compounding to achieve resistance up to 160°F. over a wide range of mild acids, brines, detergents, oils and liquid fertilizers was relatively simple. The real problem was molding. Sirvene engineers knew that conventional methods would not assure the required flex strength. They also knew the molding technique that *would*—and went to work. Test runs on this Sirvene impeller proved out the technique and the part was approved for production. "That was five years ago," states Mr. Cook, President of Hypro Engineering, "and we haven't had an impeller problem since. When you need a flexible molded part, call in C/R Sirvene engineers. Their experience and facilities are unmatched."

Write for your copy of the new booklet, Sirvene.

SIRVENE DIVISION

CHICAGO RAWHIDE

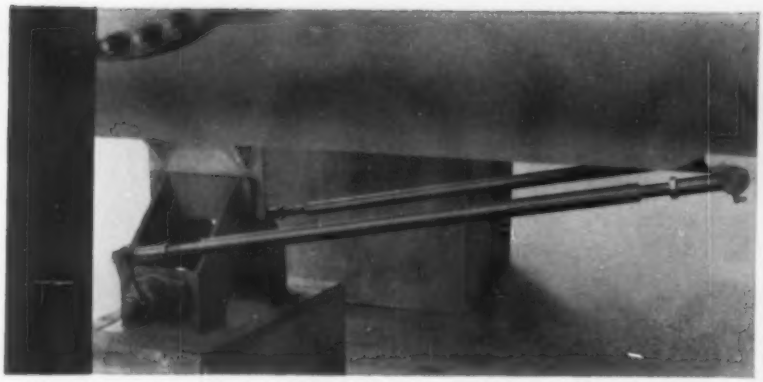
CHICAGO RAWHIDE MANUFACTURING COMPANY

1203 ELSTON AVENUE • CHICAGO 22, ILLINOIS

Offices in 55 principal cities. See your telephone book.

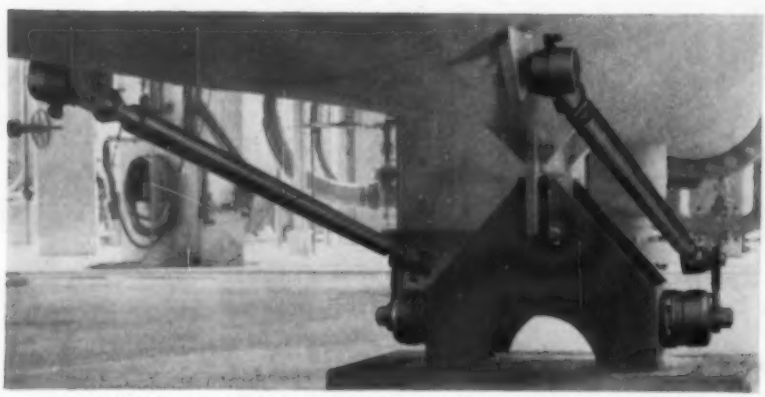
In Canada: Manufactured and Distributed by Chicago Rawhide Mfg. Co. of Canada, Ltd., Brantford, Ontario. Export Sales: Geon International Corp., Great Neck, New York.

Other C/R Products: C/R Shaft and End Face Seals • Sirvis-Conpor mechanical leather cups, packings, boots • C/R Non-metallic Gears



stop vibration damage

HOUDAILLE rotary shock absorbers



● Houdaille units installed on a regenerative riser line at a California cracking plant.

IN REFINERY AND PIPELINE OPERATIONS, Houdaille Rotary Shock Absorbers offer the *most practical solution* to pipeline vibration caused by the surge of oil under high pressure and temperature. If not controlled, this vibration and "pipe hammer" soon causes pipe fatigue, with cracking and leaking at joints and welds.

HOUDAILLE ROTARY SHOCK ABSORBERS are recommended and used by leading refinery designers and engineers throughout the world.

Exclusive rotary design • Easily installed • Readily serviceable • Sealed against dirt, water, corrosion • Long trouble-free life

Write for **FREE TECHNICAL BULLETIN** on Houdaille Rotary Shock Absorbers.

HOUDAILLE

HOUDAILLE FIELD ENGINEERS are available for consultation. Or send details of your problem direct to . . .

Houdaille Industries inc.

BUFFALO HYDRAULICS DIV. • 537 E. Delavan Ave., Buffalo 11, N. Y.

BRIEFS

Prior to his present position, Mr. Menard was director of Heald's Research and Development Div. for four years, and was also in charge of new development on automatic boring machines.

• **MORTON M. COKER**— Since 1945, Morton Coker's main interest at Caterpillar Tractor Co. has been in hydraulic controls. He has worked in nearly all phases of engineering, since joining Caterpillar in 1936, and has done detailing, checking, layout, drafting, and designing. He is presently Staff Engineer.

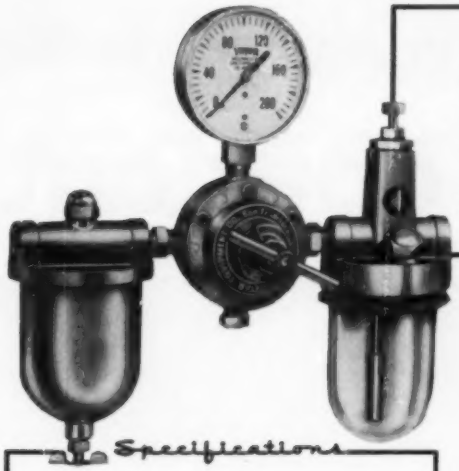
Coker's work in the fluid power field includes development of hydraulic control units, filtration systems, and steering control valves for bulldozers, scrapers, and shovel loaders. Working with component manufacturers, he has helped improve service life, pressure ratings, and performance of pumps for mobile equipment.

To receive a copy of
THE FLUID POWER PRIZE PAPER RULES BOOKLET
Circle 240 on Reader Service Card

To eliminate pipe threads from hydraulic system piping, he made the first high pressure applications of straight thread, O-ring fittings for flexible hose. He has also designed hydraulic power units in which the pump, valves, reservoir, and connecting piping are in one integral unit. This unit is sealed from atmosphere and uses a relatively small amount of reservoir oil amounting to less than 10% of pump capacity.

Coker, who earned his engineering education at Bradley University, is a member of the Society of Automotive Engineers and the American Ordnance Association. In addition to his responsibility for coordination of hydraulic projects, he also provides consulting service on hydraulic component design and application for his company's various plants. ▼▼

Continued on page 37



PNEUMATIC CONTROLS BY VICTOR

FOR AIR-OPERATED TOOLS AND MACHINERY

FILTER Reliable operation of air equipment is dependent on removal of dirt, pipe scale and condensation from the air supply.

1. **A Porous Sintered Bronze** element provides maximum impurity trapping action with minimum air flow resistance (approximately 3 p.s.i. per 10 c.f.m.).
2. **Inlet Designed** to deflect the incoming air in a downward spiral motion to trap condensation and impurities which are removed through the petcock at the bottom of the bowl.
3. **Readily Disassembled** for complete cleaning by the removal of the top body nut.
4. **Available With Steel or Plastic Bowl.** Metal bowl is recommended for installations involving rough usage. The tough, durable plastic bowl is desirable because it provides full view of filtering action, showing condition of the air line and when to drain filter.

REGULATOR The VICTOR A-250 and A-375 Air Regulators are for reducing supply line pressures to required operating pressures and maintaining a constant pressure and flow of air to cylinders, pneumatic tools, and other types of air equipment.

1. **Self-Relieving Feature** protects equipment from over-pressure and permits relieving of delivery pressure by backing off the adjusting screw.
2. **Minimum Pressure Drop** is provided by a siphon port in the low pressure chamber which increases diaphragm response to delivery pressure demands.
3. **Freedom From Chatter** is made possible by a new design using a special "O" ring guide in the seat holder which effectively dampens out vibration under flow conditions.
4. **Simple, Sturdy Housing** of quality treated aluminum provides full strength and service without unnecessary weight. Internal parts are designed for simplicity and long life. Regulators laboratory tested millions of cycles, to insure trouble free operation under working conditions.
5. **Maximum Trouble-Free Diaphragm Life** is assured by the use of highest quality neoprene that will not separate or rupture.
6. **Trouble-Free Seat Life and Full Air Flow** is assured by an exclusive seat and nozzle design utilizing a precision molded half round neoprene seat against a flat face nozzle.
7. **Valve Seat Assembly Readily Accessible** for inspection by removing back plug.
8. **Sturdy Adjusting Screw** with smooth rolled threads, operates through a steel insert bushing. A lock-nut is provided for holding pressure settings. Adjusting screw can also be wire sealed through convenient tabs on bonnet to conform to JIC pneumatic standards.

LUBRICATOR The VICTOR Lubricator provides a dependable and accurate source of wear-protecting lubrication for all types of air equipment such as chucks, screw drivers, grinders, hoists, chipping hammers, air cylinders, etc.

1. **Visual Setting** of the lubrication rate results in correct oiling without guessing. The precision needle valve provides a wide range of accurate and consistent oil flow to the air line under operating conditions.
2. **Reliable Lubrication Rate.** The VICTOR Lubricator is designed to eliminate air locking and over feeding of oil into the line when the air flow stops or fluctuates. A filter in the oil feed line insures a constant flow of clean oil to the metering valve at all times.
3. **The Visual Oil Supply Cup** is made of a durable and tough plastic with a safety factor of 5 times the recommended maximum working pressure of 125 p.s.i. It has a 1/3 pint capacity.
4. **Oil Cup Easy to Fill.** Refilling can readily be accomplished through the filler plug without shutting off the air supply. The oil cup can be removed for cleaning or filling without shutting down the air supply, if the filler plug is removed before loosening the cup retaining nut.

No. 44

Specifications

MODEL COMBINATIONS

	MODEL	WEIGHT
FRL	FRL-250	5 lb. 14 oz.
	FRL-375	5 lb. 14 oz.
	FRL-250P	5 lb. 14 oz.
	FRL-375P	5 lb. 14 oz.
FL	FL-250	3 lb.
	FL-375	3 lb.
	FL-250P	3 lb.
	FL-375P	3 lb.
F	F-250	1 lb. 7 oz.
	F-375	1 lb. 7 oz.
	F-250P	1 lb. 7 oz.
	F-375P	1 lb. 7 oz.
FR	FR-250	4 lb. 5 oz.
	FR-375	4 lb. 5 oz.
	FR-250P	4 lb. 5 oz.
	FR-375P	4 lb. 5 oz.
R	A-250	2 lb. 14 oz.
	A-375	2 lb. 14 oz.
RL	RL-250	4 lb. 7 oz.
	RL-375	4 lb. 7 oz.
L	L-250	1 lb. 9 oz.
	L-375	1 lb. 9 oz.

All 250 Models have ¼"-18 NPT(F) Inlet and Outlet Connections.

All 375 Models have ⅜"-18 NPT(F) Inlet and Outlet Connections.

NOTE:
All Filters, Regulators, and Lubricators listed have left hand inlets. If right hand inlet is desired, place "R" after the model number.

VICTOR for welding

VICTOR EQUIPMENT COMPANY

Mfrs. of welding & cutting equipment; hardfacing rods, blasting nozzles; cobalt & tungsten castings; straightline and shape cutting machines.

844 Folsom St., San Francisco 7 • 3821 Santa Fe Ave., Los Angeles 58

CIRCLE 139 ON READER SERVICE CARD

Correct Lubrication in Action . . . in the

Maintenance cost cut

Mobil

Complete Engineering Program
Proved Petroleum Products

Mobil

SOCONY MOBIL OIL CO., INC., and Affiliates: MAGNOLIA PETROLEUM CO., GENERAL PETROLEUM CORP., MOBIL OVERSEAS OIL CO., INC.

Heavy Equipment Industry!

$58,500 in one year!

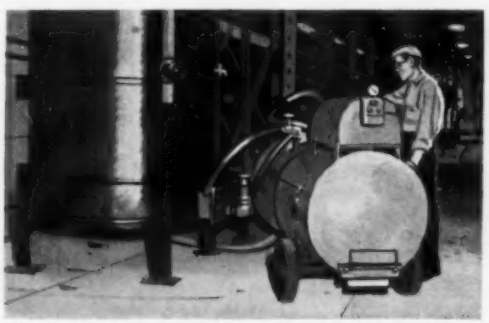
One of the many maintenance and production savings achieved by Fairbanks, Morse & Company with the help of Socony Mobil

In 1949, Fairbanks, Morse & Co. installed a Mobil Program of Correct Lubrication. This decision has continually paid off, as it can for you, by directly contributing to company profits.

To illustrate: First year after installation of a Mobil Program in the company's Beloit, Wisconsin plant figures showed machine repair maintenance costs were reduced 26.3 percent . . . $58,500. In fact, plant supervisors and Mobil engineers have co-operated so effectively under this service that today . . . nine years later . . . the Program shows continuing benefits, with the result that machine repair maintenance costs are now 49 percent lower than when the Program was inaugurated.

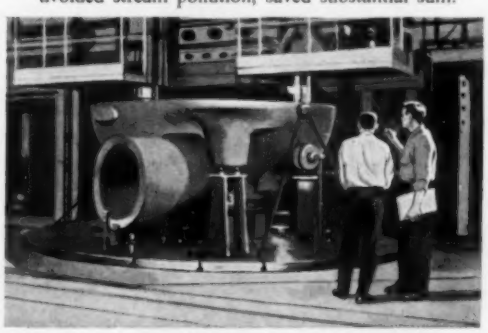
In dollars, this saving yearly is in excess of *twice the cost of plant lubricating oil requirements.* Here is another example of how Correct Lubrication in action can reduce maintenance costs and *increase profits.* It proved effective for this leading builder of heavy equipment. Why not for you?

In-plant training conducted by Mobil specialists demonstrates proper lubricant application and maintenance procedures . . . teaches Fairbanks, Morse personnel to recognize and prevent trouble before it results in downtime, repair costs.



Disposal of thousands of gallons of water-soluble cutting oils posed serious, expensive problem. Mobil recommendation of chemical separation process allowed disposal through plant sewage system . . . avoided stream pollution, saved substantial sum.

Control system cuts downtime:—Mobil lubrication charts cover plant's 2,300 machines . . . specify correct lubricants, lubrication periods . . . assure follow-through on application and maintenance.



High temperatures of Boring Mill way lubricant lowered viscosity . . . resulted in pressure drop, causing machine to stop. Mobil recommendation solved problem, allowed continuous operation.

Correct Lubrication

Another reason You're Miles Ahead with Mobil!

ACCO
Helicoid Gage
U.S.A.

NOTHING BUT THE BEST IN GAGES FOR WORKING PRESSURES FROM 30" VACUUM TO 10,000 p. s. i.

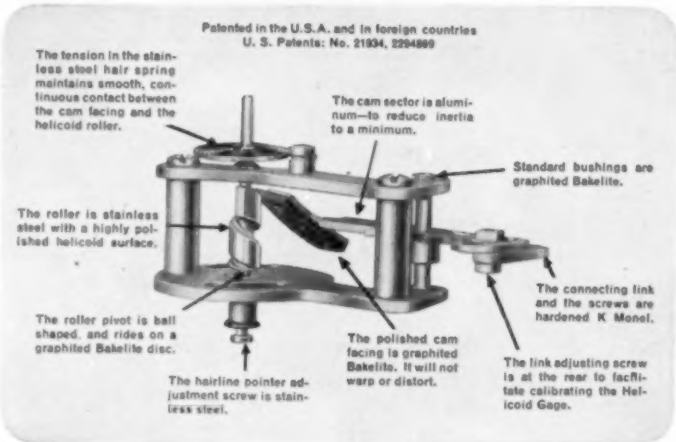
Shock-Proof Cam Actuation (no gears—no teeth) Makes Helicoid Gages Ideal for Hydraulic Services

Designed for pulsating and impact hydraulic service, the Helicoid movement releases at zero in the event of sudden pressure reduction. This eliminates shock on pointer and movement by reducing impact of pointer against pointer stop pin. This protects the gage mechanism where gages may be subject to occasional vacuum.

The superiority of Helicoid Gages is most evident in severe service—wherever a gage is subjected to violent pressure pulsations or certain severe mechanical vibrations.

The *sustained accuracy* of Helicoid Gages over *millions of cycles* is explained by the details of design and construction of the Helicoid movement shown at the right.

Rolling action of the cam facing against the roller surface . . . graphited Bakelite bushings, roller pivot base and cam facing . . . K Monel connecting links and screws . . . all such Helicoid features protect against wear and corrosion and assure sensitivity, sustained accuracy and trouble-free operation through millions of cycles.


Patented in the U.S.A. and in foreign countries
U. S. Patents: No. 21934, 2294899
The tension in the stainless steel hair spring maintains smooth, continuous contact between the cam facing and the helicoid roller.
The cam sector is aluminum—to reduce inertia to a minimum.
Standard bushings are graphited Bakelite.
The roller is stainless steel with a highly polished helicoid surface.
The connecting link and the screws are hardened K Monel.
The roller pivot is ball shaped, and rides on a graphited Bakelite disc.
The polished cam facing is graphited Bakelite. It will not warp or distort.
The link adjusting screw is at the rear to facilitate calibrating the Helicoid Gage.
The hairline pointer adjustment screw is stainless steel.

HELICOID GAGE CARTRIDGE SNUBBER

(Patent pending)

This is a simple, effective throttling device to reduce or eliminate pulsations of the gage pointer. There are no moving parts, no adjustments needed. Available in three types in powdered bronze or stainless steel for air, gas, water, steam, medium or heavy liquids.

Enlarged cutaway view

Threaded cartridge body for assembly in any Helicoid Gage tapped socket shank

EASIEST ADJUSTMENT AND CALIBRATION

Only Helicoid Gages have the external pointer adjustment pictured here. The Helicoid type adjustment cannot be jarred out of position.

Calibration of Helicoid Gages is accomplished easily, without removing dial or pointer, because the link adjusting screw is at the rear of the system.

TUBES BUILT FOR MILLIONS OF PRESSURE PULSATIONS

To fit the wide range of applications, Helicoid Bourdon tubes are available in four materials—alloy steel, K Monel, stainless steel and phosphor bronze.

All Helicoid tubes are made from seamless tubing and are carefully designed to give maximum torque and minimum stress. When used within the dial range, they will withstand many millions of pressure pulsations and will not stretch, leak nor crack.

DOUBLE SCALE DIAL SHOWS TONS ON RAM AND PSI

Helicoid Gage dials are supplied in jet black with white figure markings or in dull white with black figure markings. They are constructed of laminated phenol with a transparent plastic surface and the longest possible scale length for more accurate readings. They are non-corroding, will not discolor nor fade and will not crack, chip nor peel.

ACCO

Helicoid Gage Division
AMERICAN CHAIN & CABLE

929-H Connecticut Avenue • Bridgeport 2, Connecticut

TRADE MARK

Helicoid gives you all these features at prices that are competitive in the quality gage field

BRIEFS

Oil Cylinders Give Torque To Bend Pipe

Two hydraulic cylinders mounted side by side apply a 7 ton pull to roller chain. Chain and sprocket linkage converts the pull to 275,000 in.-lbs. of torque at ½ rpm. That's the power story on a portable pipe bender used on a construction site by Bechtel Corp.

Manual control is provided by a 4-way open center valve. Cam-operated valves provide automatic limit stops accurate to 2/10ths of 1 degree of bend angle. A pressure-regulating valve maintains

constant tension in the chain. The absence of relays and solenoids makes the unit safe for use under the most hazardous conditions.

The output torque of 275,000 inch pounds is sufficient to bend 3″ schedule 80 stainless steel pipe. A 180 degree bend is made in 60 seconds with return to start position in 25 seconds. This portable unit is the result of combined design-engineering efforts of the Fornaciari Company and Engineering Associates in Los Angeles.

▼▼▼

Sewer Pipe Presses

High-volume hydraulic sewer pipe presses operate on a low pressure oil system at about 40 per cent of the cost of steam operation. Pearne and Lacy Machine Co. Inc., El Monte, Calif., builds the units for extruding large clay pipe. The presses attain higher clay pressures than standard steam presses, provide higher quality and greater production for pipe

Continued on next page

THE ALL PLASTIC VALVE THAT

DEFIES CORROSION

VALCOR's all plastic, corrosion-resistant solenoid valve, SV-5100 series, is the only solenoid valve that has no metal contact with the fluid—ever. Specifically designed to handle most of the corrosive media so widely used in industry, VALCOR's new, all plastic solenoid valve will, in many cases, outlast stainless steel valves 100 to 1.

If you have a corrosive media problem, from sulphuric acid solutions to citrus juices, try this new VALCOR valve on your toughest application. Prove for yourself how this new valve defies corrosion. List prices start at $8.50.

IMPORTANT: Hundreds of other valve variations, in design and pressure ratings, are inherent in this new SV-5100 series. By incorporating some of the very newest engineering and chemical formulas, we can offer valve variations designed to meet almost any corrosion problem you might be faced with.

Write today for new catalog sheet. For specific information, please send us pertinent application details.

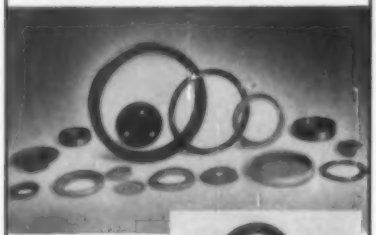
VALCOR ENGINEERING CORP.
5368 CARNEGIE AVENUE, KENILWORTH, NEW JERSEY

VALCOR
SOLENOID VALVES

For Efficiency & Long Life

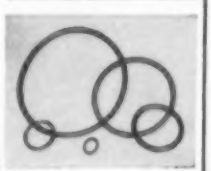
GRATON AND KNIGHT®

MECHANICAL PACKINGS



LEATHER

SYNTHETIC



"O" RINGS

CUP

FLANGE

"U"

"V"

WASHERS

"O" RINGS

Looking for packings that have proven their ability to withstand high pressures and severe operating conditions? G&K offers you just such packings in their complete line of leather, synthetic and "O" rings. You can be sure that the packings G&K engineers recommend will do the job better and last longer.

Remember G&K . . . world's largest manufacturer of industrial leathers were pioneers in the manufacture of mechanical leather packings and are equipped to solve your packing problems . . . For service and quality you can count on G&K.

Write today for detailed information on G&K packings

GRATON & KNIGHT Company, Inc.

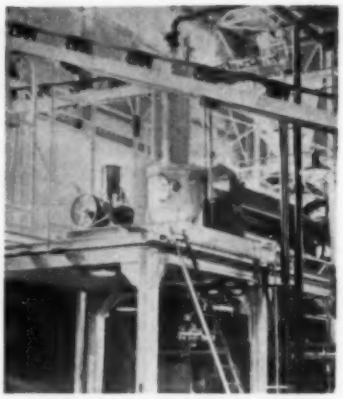
WORCESTER 4, MASSACHUSETTS

BRIEFS

from 15-in. to the largest sizes required. Three models have capacities from 133 tons to 220 tons and use either one or two 300 gpm pumps.

• **Operation**—Pressing the control lever down drops the mud head by gravity. Pressure is applied automatically as the mud head contacts the clay, and the extrusion made. On the up-stroke, a small internal cylinder returns the main ram and mud head. An automatic by-pass prevents the main ram piston from contacting the upper cylinder head.

• **Control**—A control valve integral with the hydraulic cylinder head is operated by a servo slave and master system which gives finger-tip control. A die locker control switch, operated by the forefinger, and a pipe cut-off control switch operated by the thumb



are located on the control lever. The power scale rod is controlled and brake through pedals mounted by a hydraulically operated clutch on the operator's platform. ▼▼▼

Continued on page 40

BRIEF NOTES

MINNESOTA RUBBER COMPANY . . . is the new corporate name of Minnesota Rubber and Gasket Company. The name change and a realignment of the company's five subsidiaries has been announced by Robert W. Carlson, President. The subsidiaries have been centralized and given divisional status within the parent company. George W. Carlson is now chairman of the board of directors.

ASTE EXPANDS PROGRAM . . . At the society's semi-annual meeting in Milwaukee, the framework was established for an expanded member-industry service program which includes creation of a school and training center for tool engineers, a research center with laboratory facilities, more technical publishing activities and more space for headquarters.

STAINLESS STEEL TUBING WITH MIRROR-SMOOTH INTERIOR . . . Summerill Stainless Tube Div. of Columbia Steel and Shafting Co., Carnegie, Pa., is now producing mandrel-drawn tubing with extremely smooth I. D. at no extra cost to users. Called "Lustraloy" the new product is being manufactured at a specially built plant at Scottdale, Pa.

BUSINESS BRIEFS

FLICK-REEDY DECLARES DIVIDEND . . . A dividend of two cents per share on its $1 par common stock was announced Jan. 13 by the board of directors of Flick-Reedy Corporation, Melrose Park, Illinois. The manufacturing divisions of Flick-Reedy Corporation are: Miller Fluid Power and Tru-Seal.

PORTER ACQUIRES 40% OF THERMOID STOCK . . . H. K. Porter Company, Inc. has acquired approximately 325,000 shares of Thermoid common stock from the Graham-Paige Corporation and certain of their associates.

10 PERCENT INCREASE IN AIR VALVE PRODUCTION EXPECTED IN 1958. . . says R. J. Cameron, president of Ross Operating Valve Co., world's biggest producer of industrial air control valves. Cameron bases his prediction on increasing knowledge of air power's advantages among design engineers.

CIRCLE 52 ON READER SERVICE CARD

CIRCLE 148

specify Wooster hydraulic pumps

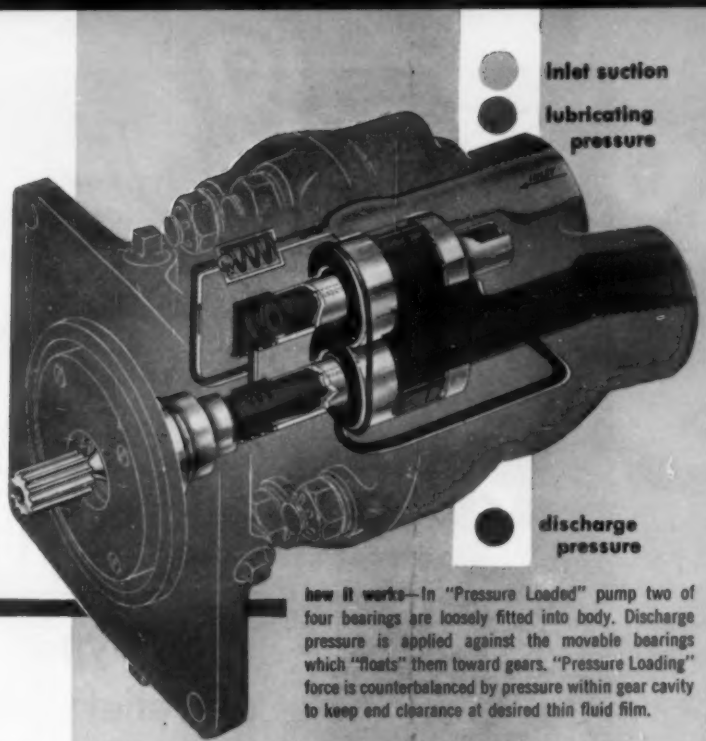
with exclusive "Pressure Loading"

"Pressure Loading" is Wooster's patented principle of construction of gear pumps which improves performance and permits operation under difficult, high-pressure conditions. Used on over one million pumps, it provides (1) higher operating efficiencies, (2) sustained new pump efficiency throughout an extra-long service life by automatic take-up for any wear, (3) uniform flow rate regardless of variations in load, oil viscosity or temperature and (4) a smaller, lighter pump for a given installation.

"Pressure Loading" utilizes the discharge pressure of the pump to continually maintain a minimum end clearance between gear and bearing faces. This eliminates the leakage path back to the inlet, compensates for temperature and viscosity changes and corrects for any wear. Volumetric efficiencies to 97% and torque efficiencies to 92% are achieved.

Wooster Hydraulic Pumps provide outstanding performance on agricultural, construction, materials handling and industrial equipment. For further information, use the coupon or contact:

WOOSTER DIVISION
BORG-WARNER CORPORATION
Old Mansfield Road • Wooster, Ohio



how it works—In "Pressure Loaded" pump two of four bearings are loosely fitted into body. Discharge pressure is applied against the movable bearings which "floats" them toward gears. "Pressure Loading" force is counterbalanced by pressure within gear cavity to keep end clearance at desired thin fluid film.

Ratings of Typical Wooster Hydraulic Pumps

displacement cu. inches per rev.	model series	rated capacity gpm	rated speed rpm	rated pressure psi	maximum operating speed—rpm	maximum operating press.—psi	type * drive
.043	051050	.7	4500	3000	4500	3000	II
.060	051089	.4	1800	600	4500	2000	II
.063	051737	.6	2500	1000	5000	2000	I & II
.078	051857	1.5	4900	1400	5000	1500	II
.086	051488	.6	1760	500	5000	1000	II
.204	052247	2.5	3250	3000	3250	3000	II
.238	051004	2.5	2880	1200	3600	1800	I & II
.433	051012	4.5	2800	1200	3600	1200	I & II
.577	051001	5.0	2000	1500	3200	2500	I & II
.77	051029	11.0	3200	1000	3000	1500	I & II
.88	052792	10.5	3200	1200	3500	1500	I & II
.97	052057	10.5	2800	1000	3000	1500	I & II
1.10	051057	7.0	1650	1000	3000	1500	II
1.20	051051	9.0	2000	1400	2000	1500	II
1.32	051002†	10.0	2000	2000	2500	2000	I & II
1.35	052889	9.0	1800	1000	3000	1500	II
1.55	051066	10.0	1650	1200	1800	1500	II
1.56	052973†	12.0	2000	2000	2500	2000	I & II
1.70	051091	8.0	1200	1200	2500	1500	II
1.8	052858	12.0	1800	1000	2500	1500	II
1.93	052941†	16.0	2200	1500	2500	1750	I & II
2.20	052168	12.0	1450	1200	1800	1500	II
3.207	051006	15.0	1200	1000	1800	1500	I & II
3.5	051080	13.75	1000	1200	1800	1500	I
4.07	051758	32.0	2000	1000	2000	1500	I & II
6.75	051552	40.0	1500	1500	1800	1500	I & II
8.35	051553	48.0	1500	1500	1800	1500	I & II
12.5	052367	60.0	1200	1500	1500	1500	II

*Type I—For Belt, Chain, or Gear Drive.
*Type II—For Direct Coupled Drive.
†Optional Mountings.

WOOSTER

B-W BORG-WARNER TRADEMARK

Wooster Sales Offices:
CHICAGO—CEntral 6-8980 DETROIT—UNiversity 2-4712
LOS ANGELES—STate 9-0487 PHILADELPHIA—WAlnut 5-4020
CLEVELAND—LOngacre 1-2612

Wooster Division, Borg-Warner Corporation, Old Mansfield Road, Wooster, Ohio

Please send information on Pumps ☐ Motors ☐ Valves ☐ Power Packages ☐

Name_____

Title_____

Company_____

Address_____

City_____ Zone____ State_____

Low price and high quality make FULFLO Pressure Control Valves a natural choice for O.E.M. installation. The service they deliver . . . quiet, dependable, trouble-free . . . makes them ideal from the equipment users' viewpoint too! Available with "O" Ring or Gasket Seal.

- Standard and Flanged models
- Just 6 springs for pressures to 500#
- Cast iron or brass bodies
- Brass, steel or stainless pistons
- Pipe sizes to 2½"
- SPECIALS to your requirements

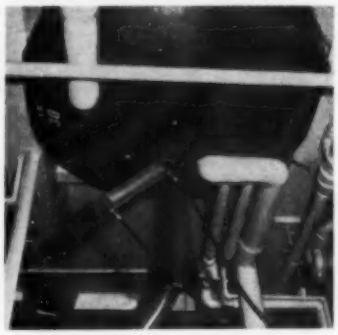
FULFLO

WRITE for "Fulflo Valves Mechanical Data Book," free helpful reference

THE FULFLO SPECIALTIES CO., Inc.

415 Fancy Ave. • Blanchester, Ohio

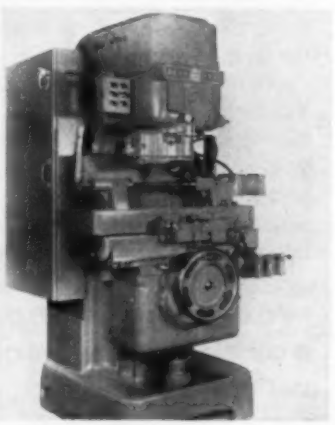
BRIEFS



Hydraulic cylinder operates valve at bottom of tank controlling compound to mixing kettle below. Cylinder is supplied from header also supplying fluid motors driving kettle agitators. System is non-flammable for operation in explosive atmosphere of pharmaceutical plant. Ciba Pharmaceutical Products Inc. Summit, N. J.

Gear Honing Machine Uses Pneumatics

Pneumatics plays several roles in this gear tooth honing machine that is built by National Broach and Machine Co., Detroit, Michigan. The machine has the headstock and air powered tailstock mounted on a patented tilting table. The tilting table is attached



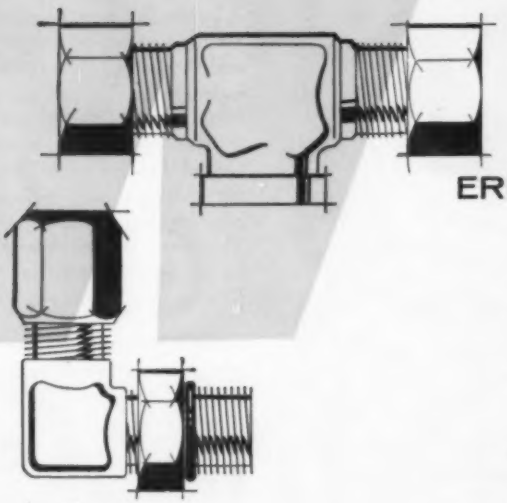
to the reciprocating work table through a hinged mechanism. The tilting table is air-cylinder actuated.

• **Air controls**—For removing nicks and burrs and improving surface of hardened gears a con-

Continued on page 42

WEATHERHEAD

steel tube fittings for high-pressure applications

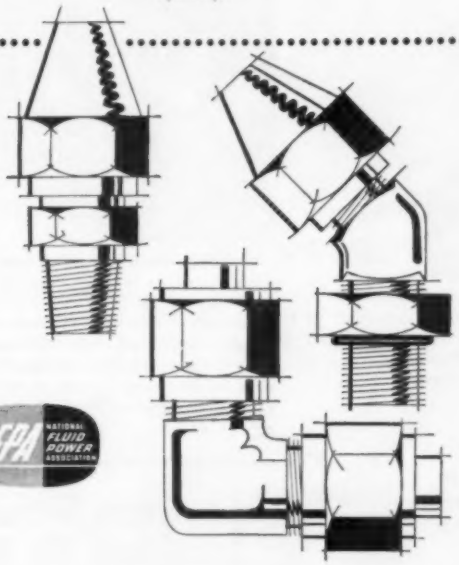


ERMETO®

NO FLARING • NO THREADING
NO WELDING • NO SOLDERING

Steel and stainless steel Ermeto fittings in sizes and types to meet any high-pressure need. Also straight-thread Ermeto fittings to meet new S.A.E. boss specifications.

NOTE—All 7000 Series straight-thread Ermeto fittings and components have corrosion-resistant "Weathercote" finish.

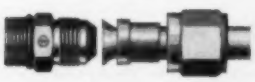


FLARE-TWIN*

S.A.E. 37° Flare-Twin (J.I.C.) fittings are available with Dryseal-thread or with new straight-thread in popular styles and sizes for S.A.E. "O" ring boss design. Available with cadmium-plate or new corrosion-resistant Weathercote finish.

Trade name for the new Weatherhead 37° flared fitting.

3-PIECE TYPE



2-PIECE TYPE

NFPA NATIONAL FLUID POWER ASSOCIATION

AVAILABLE COAST-TO-COAST THROUGH WEATHERHEAD DISTRIBUTORS

WEATHERHEAD
FIRST IN HYDRAULIC CONNECTIONS

THE WEATHERHEAD CO., FORT WAYNE DIVISION
Dept. A-3, 128 West Washington Blvd., Fort Wayne, Ind.
In Canada: The Weatherhead Co., Ltd., St. Thomas, Ontario

DASH CONTROLS

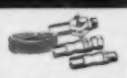
BRASS

DRAIN AND SHUTOFF COCKS

SAE FLARE-TWIN (JIC)

ERMETO®

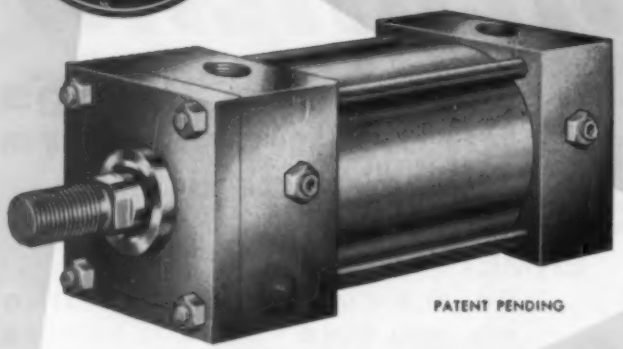
SELFALIGN®


BULK HOSE AND REUSABLE HOSE ENDS

HOSE ASSEMBLIES

FOR AUTOMATION

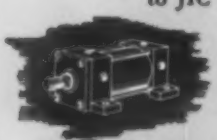
SP CYLINDERS



PATENT PENDING

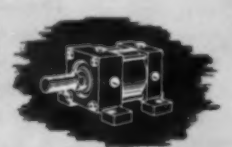
top performance–longest life

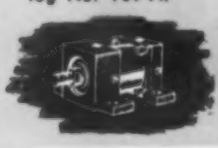
All S-P cylinders are engineered throughout for high speed, efficient operation. Piston rods are heat treated and hard chrome plated to resist scoring. Bronze cartridges with extra long bearing surfaces are easily removable for quick servicing of rod seals and wipers. End plates are rolled steel. All S-P cylinders are built to JIC standards.



S-P STANDARD AIR CYLINDERS have brass tubes to eliminate corrosion. Cushions float on O-rings for maximum cushioning. Eleven bore sizes, 1½" — 14". 21 mounting types. Readily modified for oil or water. Send for Catalog No. 110.

S-P HEAVY DUTY AIR CYLINDERS for automation and other severe applications. Double porting for extreme high speeds. Heavy wall seamless steel tube. Nine bore sizes, 1½" — 8". Five mounting types. Approved and used by two major automobile manufacturers. Send for Catalog No. 109-A.





S-P HIGH PRESSURE HYDRAULIC CYLINDERS have seamless steel tube. Special locking mechanism eliminates tie rods. Designed for 2,000 psi. Eleven models in 11 sizes. Send for Catalog No. 104.

Step up production with S-P cylinders. Representatives in principal cities. Prompt deliveries. Order catalog by number shown above. The S-P Manufacturing Corporation, 30201 Aurora Rd., Solon, Ohio. *In greater Cleveland.*

SPecify SP

SP THE S-P MANUFACTURING CORP.

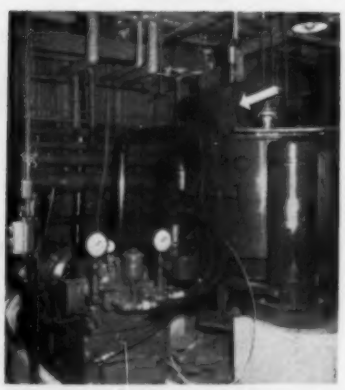
SOLON, OHIO • *IN GREATER CLEVELAND*

ESTABLISHED 1916 A BASSETT COMPANY

NON ROTATING AIR AND HYDRAULIC CYLINDERS • ROTATING AIR AND HYDRAULIC CYLINDERS POWER CHUCKS • COLLET AND DRILL PRESS CHUCKS • AIR PISTONS, VALVES, ACCESSORIES

BRIEFS

stant-pressure arrangement is provided by the tilting table. The table is tilted down for loading by operating an air valve control. When the constant-pressure valve is actuated the work is brought into tight-mesh contact with the abrasive-impregnated, gear-shaped, plastic honing tool. A controlled pressure condition is maintained between the work gear and the honing tool by an air cylinder. When more tooth shape correction is desired the work is tilted into tight mesh under controlled loading conditions by an air cylinder and locked in that position by another air cylinder. The work is then honed in fixed center-distance relation with the honing tool. ▼▼▼

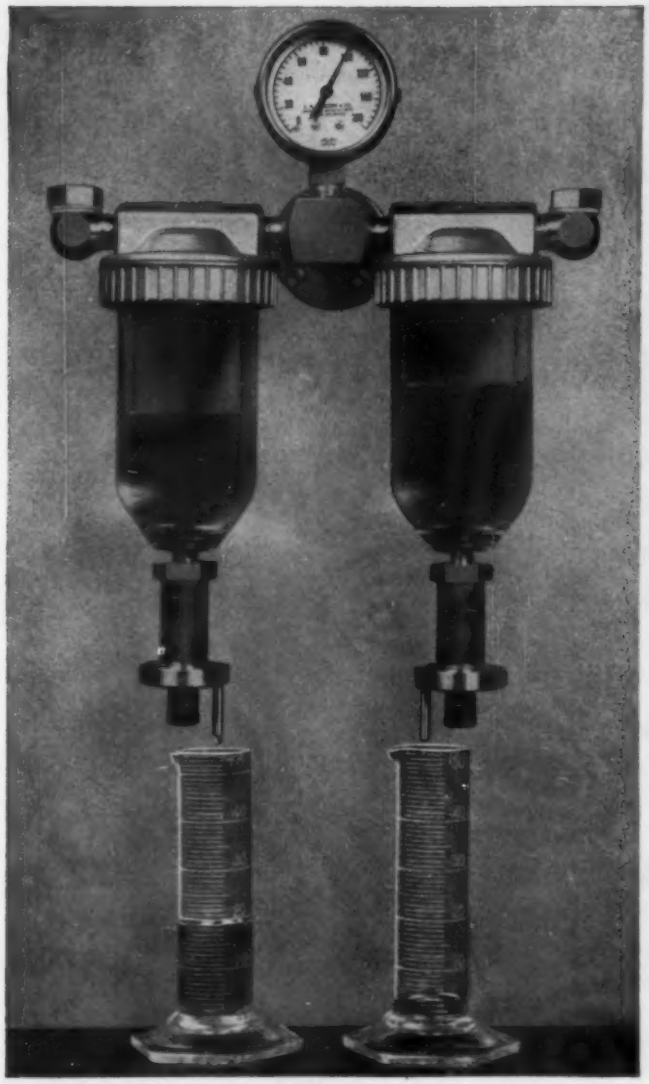


Variable volume pump and fluid motor drive centrifuge in pharmaceutical operation giving infinitely variable speed according to process. Reciprocating scraper controlled by hand-operated valve (arrow) removes compound from sides of centrifuge at end of operation. Ciba Pharmaceutical Products Inc., Summit, N. J.

Electro-Hydraulics Smooths The Road

• **Road grader guidance**—Sanders Associates, Inc. has agreed to produce an undisclosed number of road-grader control systems for the Galion Iron Works & Manufacturing Co. of Galion, Ohio. The Galion Co. will use the system to control the blade angle of road

Continued on page 44



SUNTAC CUTS HYDRAULIC OIL LOSS AS MUCH AS 75%

See this demonstration in your plant

Take about five minutes at your own desk to learn how Suntac® oils stay put in hydraulic systems . . . reduce oil loss through loose joints and worn fittings.

Match Suntac against the hydraulic oil you're now using—see how the exceptional non-gummy antileak characteristics of Suntac can reduce your oil losses as much as 75%. *Some users have even reported savings of 90%.*

ANTILEAK DEMONSTRATION

Suntac oil in one chamber, your present hydraulic oil of the same viscosity in the other. Both oils are forced out through sintered bronze bearings. In this photograph, pressure of 100 psi caused a straight mineral oil to leak out four times faster than Suntac.

Call Your Sun Representative

Have him arrange with a Sun Lubrication Engineer to give you and your staff a private demonstration. For further information on the uses of Suntac in hydraulic systems and in general lubrication, write to SUN OIL COMPANY, Philadelphia 3, Pa., Dept. AH-3.

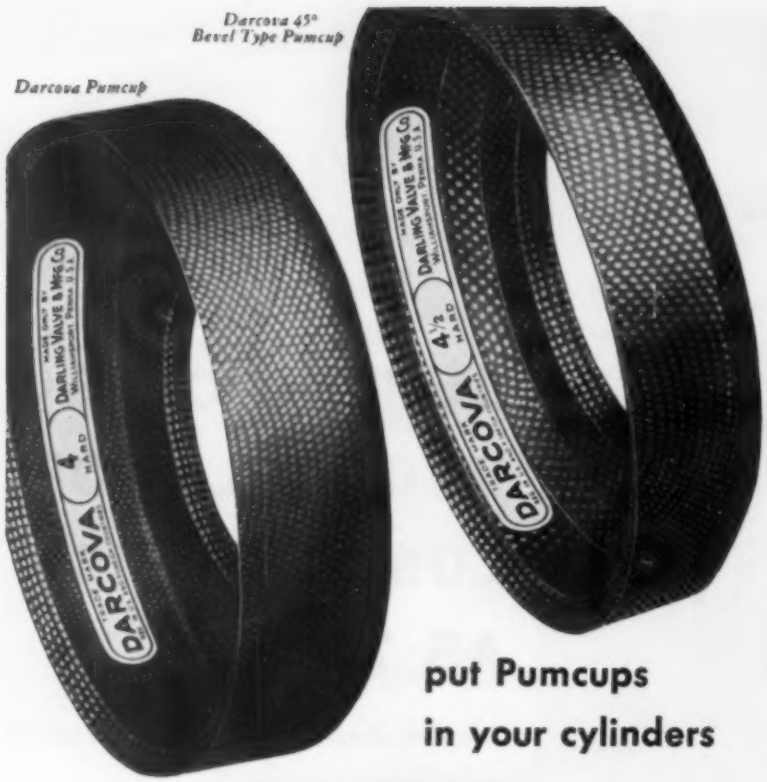
SUNOCO

INDUSTRIAL PRODUCTS DEPARTMENT

SUN OIL COMPANY PHILADELPHIA 3, PA.

© SUN OIL CO., 1957

IN CANADA: SUN OIL COMPANY LIMITED, TORONTO AND MONTREAL



put Pumcups
in your cylinders

TO HOLD PRESSURE LONGER!

In Darcova Pumcups a sound engineering principle has been combined with precision tolerances and extremely durable compositions to provide exceptional efficiency and life in hydraulic, air, and reciprocating pump cylinders of all kinds.

Unlike ordinary piston packing, precision Pumcups are engineered to minimize friction load while hugging cylinder walls on every pressure stroke. Regardless of eventual wear, efficiency *stays* high! So there's far less down-time and need for replacement.

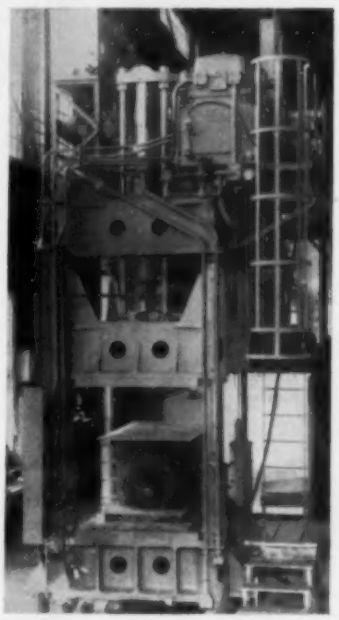
Pumcups are made in a wide range of sizes, types and texture-engineered compositions, including 100% Nylon, for all kinds of pressure-temperature-fluid conditions. Send for Pumcup Bulletin 5503 and weigh all the facts!

DARLING VALVE & MANUFACTURING CO.
Williamsport 15, Pa.

DARCOVA
THE ORIGINAL COMPOSITION CUP
TRADE MARK
PUMCUPS

BRIEFS

grading machines so that the grade is maintained constant regardless of variations in contours and roughness of the ground. The systems developed by Sanders engineers were demonstrated to a group of Galion officials during October 1957. ▼▼▼



This four-column, down-acting, metal forming press, built by Birdsboro Steel Foundry & Machine Co. of Birdsboro, Pa., has its own self-contained oil hydraulic power system. Two large radial piston pumps, driven by a 200-hp motor, deliver oil at rates up to 152 gpm. Inserted, outside-packed cylinders are used, and up-and-down full tonnage stops are provided to prevent overstroking. Bed area measures 112-in. by 61-in., and overall height is 35 feet.

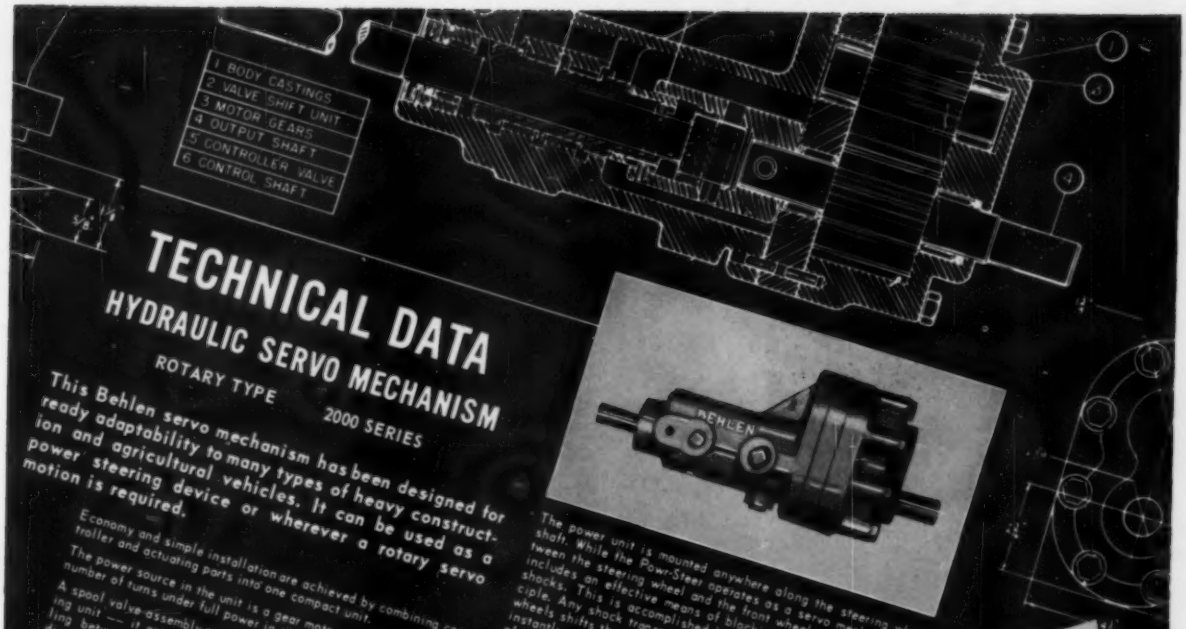
Hydraulics At The Refinery

Oil as now being used in the manufacture of oil. At the Port Credit, Ontario refinery of Regent Refining Limited electro-hydraulic valves and electronic controls are running the complete show.

• **Air eliminated**—These are the first refining units in the world designed to operate without em-

Continued on page 48

CIRCLE 37 ON READER SERVICE CARD



TECHNICAL DATA

HYDRAULIC SERVO MECHANISM

ROTARY TYPE 2000 SERIES

This Behlen servo mechanism has been designed for ready adaptability to many types of heavy construction and agricultural vehicles. It can be used as a power steering device or wherever a rotary servo motion is required.

Economy and simple installation are achieved by combining controller and actuating parts into one compact unit.

The power source in the unit is a gear motor that will rotate any number of turns under full power in either direction.

A spool valve assembly performs two functions within the unit — it acts as both the mechanical and ... ing between the input and output shafts. ... diverted to either side of the ... shifts laterally under the ... Although flow is ... until at least ...

The power unit is mounted anywhere along the steering wheel shaft. While the Powr-Steer operates as a servo mechanism between the steering wheel and the front wheels, its design includes an effective means of blocking and ... shocks. This is accomplished by a reversing ... ciple. Any shock transmittal to the ... wheels shifts the spool valve ... instantly pressurizes the ... of the gear motor ... The Powr-Steer ... draul...

SPECIFICATIONS

Class of Service: This is a fast message unless its deferred character is indicated by the proper symbol.

WESTERN UNION TELEGRAM

1201

SYMBOLS
DL = Day Letter
NL = Night Letter
LT = International Letter Telegram

W. P. MARSHALL, PRESIDENT

The filing time shown in the date line on domestic telegrams is STANDARD TIME at point of origin. Time of receipt is STANDARD TIME at point of destination

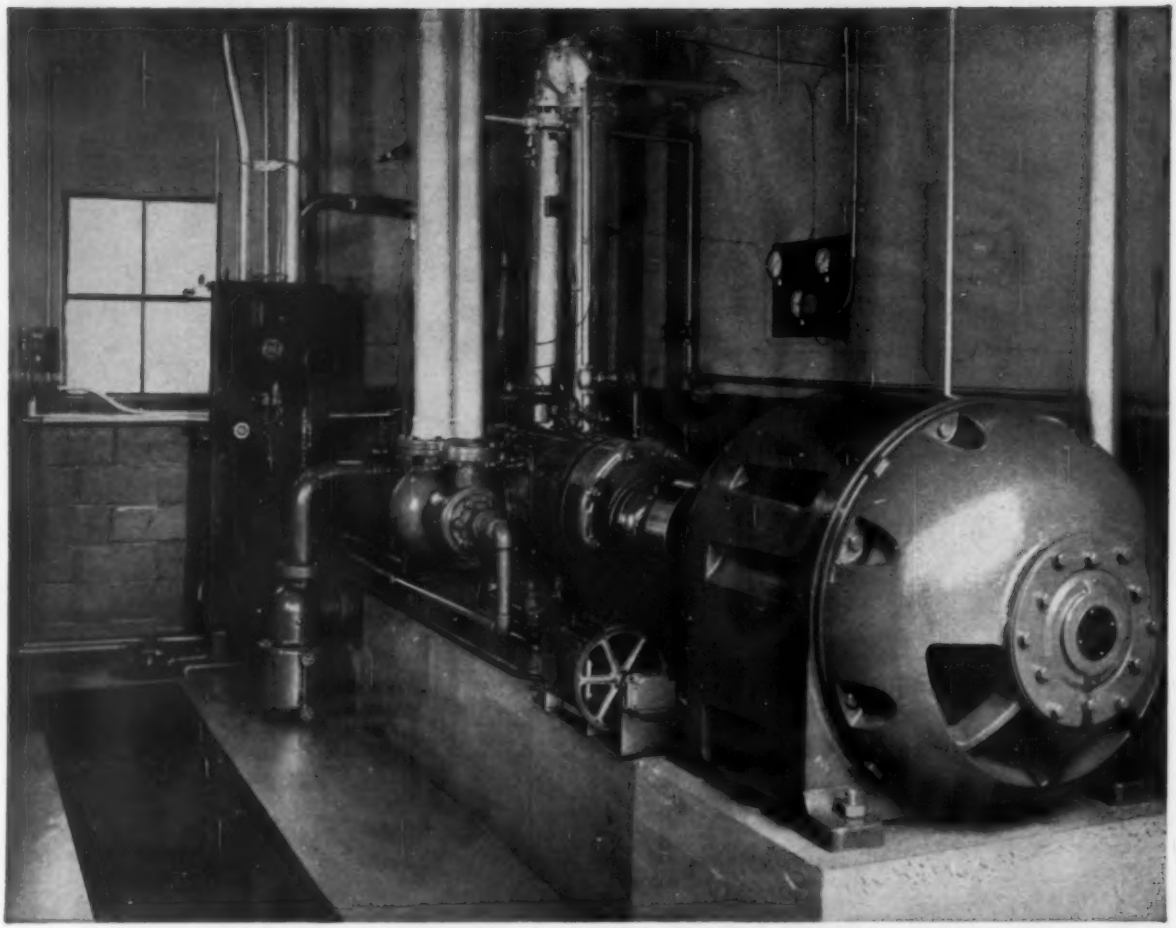
LD003 NL=WUX COLUMBUS NEBR JAN 24 1958=
PAUL ROLNICK, EDITOR & PUBLISHER DIRECTOR APPLIED HYDRAULICS=
812 HURON RD CLEVELAND OHIO=

RESERVE PAGE SPACE MARCH ISSUE FOR IMPORTANT MESSAGE FOR ORIGINAL EQUIPMENT MANUFACTURERS. DUE TO EXPANDED PRODUCTION FACILITIES BEHLEN HYDRAULIC ROTARY SERVO MECHANISM NOW AVAILABLE TO OEM ON WIDER SCALE. HUGE DEMAND IN PAST HAS BEEN IN PRODUCTS WHERE MANUAL LABOR NEEDED TO BE REDUCED. FOR EXAMPLE, SINCE 1952 THIS BEHLEN UNIT HAS ADDED SALES IMPACT OF POWER STEERING TO FARM TRACTORS, ROAD EQUIPMENT, SELF-PROPELLED VEHICLES. FOR LAST TWO YEARS HAS GONE ON LEADING TRACTOR LINE AS ORIGINAL EQUIPMENT. INVITE OEM PRODUCT RESEARCHERS TO SEE HOW EASILY WE CAN ADAPT THIS SERVO MECHANISM TO THEIR PRODUCTS. OUR PRODUCTION MANAGER HOWARD CHRISTENSEN WILL GIVE THEM HIS PERSONAL ATTENTION. REGARDS=
W D BEHLEN PRESIDENT=

THE COMPANY WILL APPRECIATE SUGGESTIONS FROM ITS PATRONS CONCERNING ITS SERVICE

Phone, Wire or Write— Behlen MANUFACTURING CO.

Dept. AH-3 Columbus, Nebraska



Fuller Rotary Two-Stage Compressor, C135-135H. Capacity 680 c.f.m., 100-lb. pressure, 690 r.p.m., 150 hp. motor.

16,000 HOURS OF OPERATION WITH NO MAINTENANCE

Empire Steel Castings, Inc., Reading, Pennsylvania, installed a C-135-135H Fuller Rotary Two-stage Compressor in April 1953. After 32 months—approximately 16,000 hours of operation—the compressor received a routine inspection, when a new set of blades was installed in the higher-pressure cylinder.

The Empire engineers report no down-time since replacement, although they've added 4,000 operating hours. Prior to switching to Fuller, their former experience with compressors was a different story—as many as several overhaulings in one year. With Fuller equipment furnishing a constant high capacity air supply, production costs have been greatly reduced.

Here's how Empire uses compressed air:

• In the molding department, supplying all air for pneumatic rammers, all squeeze and jolt machines, automatic set-out and lifting apparatus of mold conveyors, automatic shake-out machines, mold cleaning and spraying equipment.

• In the core department, for ramming equipment, spraying and torch drying equipment, core oven operation as well as core blowing equipment.

• In the cleaning department, pneumatic chipping hammers and grinders, blacksmith requirements, sand-blasting, pressure testing and miscellaneous tools.

• In the heat-treating department, heat treating furnace operation and cooling equipment.

To get all the facts and engineering data, write today for Bulletin C-5A.

C-298
3052

GENERAL

FULLER COMPANY
142 Bridge St., Catasauqua, Pa.
SUBSIDIARY OF GENERAL AMERICAN TRANSPORTATION CORPORATION
Chicago · San Francisco · Los Angeles · Seattle · Kansas City · Birmingham

Fuller

PIONEERS OF HIGH-EFFICIENCY VANE TYPE ROTARY COMPRESSORS SINCE 1930

CIRCLE 48 ON READER SERVICE CARD

NOW

for the first time

LOW COMPRESSION SET

Butyl "O" RINGS

NEW

Another LINEAR first . . . a new, low compression-set Butyl Compound for use in "O" Rings. LINEAR Butyl Compound 7806-70 is a seal material that withstands compression set at elevated temperatures without being permanently deformed or losing its resiliency and its value as a seal. Also, Butyl withstands the chemical actions of the non-flammable phosphate esters such as "Skydrol", "Pydraul" and "Cellulube."

YET, PROVEN

Exhaustive tests, under method "B" of the ASTM, show this new LINEAR compound develops only 30 to 40% compression set after 70 hours at 212°F, as compared to the usual 70 to 95% set experienced with previous Butyl compounds. This unusually good resistance to permanent deformation, combined with a tensile strength of 2000 psi and an elongation factor of 275%, make this material an outstanding one for all "O" Ring applications and other molded shapes where Butyl rubber's excellent qualities are desirable.

Whenever you have a seal problem that is tough to handle—look to LINEAR for an answer. Write, or ask the local representative for complete information on LINEAR's new Butyl Compound 7806-70—today.

"PERFECTION IN RUBBER"

LINEAR

LINEAR, Inc., STATE ROAD & LEVICK ST., PHILA. 35, PA.

Is your plant CRITICALLY SHORT of WATER?

You will make major water savings, reduce your costs, solve your problems of water supply or disposal and get HIGH OPERATIONAL EFFICIENCY with Niagara "Aero" Evaporative Heat Exchangers, After Coolers or Condensers for these important plant services or processes:

- AFTER COOLING and air drying for large air and gas compressors and AIR LIQUEFACTION
- COOLING ENGINES, COMPRESSORS, HYDRAULIC PRESSES
- COOLING QUENCH BATHS, FURNACES, INERT ATMOSPHERES
- COOLING ROLLS, WELDERS, DRAWING OR EXTRUSION DIES
- PRODUCT AND PROCESS COOLING CHEMICALS OR INTERMEDIATES
- COOLING LIQUIDS OR GASES IN CLOSED SYSTEMS
- VAPOR CONDENSING UNDER VACUUM
- ELECTRONIC PROCESS COOLING

High operational efficiency means: precise temperature for improved product and process quality control, heat removal at rate of input, simple operating conditions, real economy in upkeep, sustained full capacity.

Also it means cooling in a closed system with your product kept free from contamination or, when condensing, getting a pure condensate holding high quality in your product or material.

Niagara machines do the work of a cooling tower plus shell-and-tube coolers with a single machine that saves piping, water handling disposal and treatment expense and 95% of water consumed by contact cooling methods.

Write for Bulletin 129, 130, 132, 136R.

NIAGARA BLOWER COMPANY

Over 35 years of Service in Industrial Air Engineering

Dept. AH-3, 405 Lexington Avenue
NEW YORK 17, N. Y.

District Engineers in Principal Cities of U. S. and Canada

CIRCLE 91 ON READER SERVICE CARD

BRIEFS

ploying air in any phase of instrument control. Instead, electro-hydraulic valves are actuated directly by electrical signals from electronic control instruments which in turn, receive signals characteristic of changes in temperature, pressure or flow. Elimination of air is an important factor in cold climates where freeze-ups in pneumatic lines are a constant threat to continued efficient operation of units. ▼▼▼

Briefs from Britain

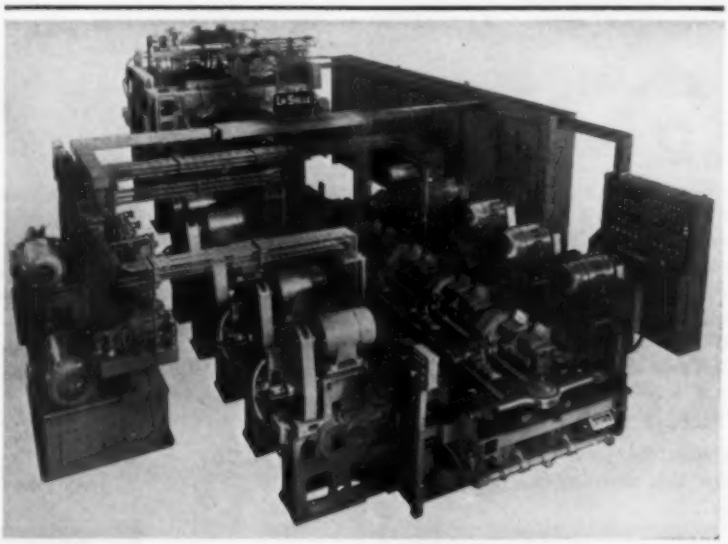
Bright Future for Transmissions

"There is undoubtedly a great future for hydrostatic transmissions, and though present developments have been mainly confined to agricultural tractors, there seems to be no reason why these transmissions should not become extremely popular for road vehicles and railroad locomotives. This was the opinion of Mr. R. H. Bound, Technical Director of the Dowty Group Ltd. speaking before the Society of Engineers in London.

R. H. Bound
Dowty Group Ltd.

A new Dowty hydrostatic transmission with a swash-plate type pump and motor has an infinitely variable transmission ratio. A single lever controls the transmission which eliminates a clutch and gear box, and also provides power braking on the driving wheels.

Continued on page 50



CONSOLE integrates hydraulic and electrical controls on this 13 station rear axle housing machine. Operation of the hydraulic and electrical systems can be followed without using circuit drawings. All hydraulic manifolds use O-ring mountings for valves and fittings. 46 operations are completed in 26 seconds on this machine built by LaSalle Tool, Inc., Detroit, Mich.

CIRCLE 86 ⟶

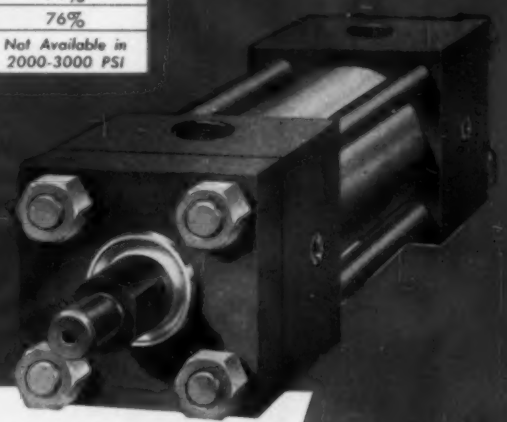
Save 27% or more in cost...

NEW Miller "JOB RATED" HYDRAULIC CYLINDER LINE

JOB RATED, MODEL " J "

BORE	SEVERE OPERATING CONDITIONS	MODERATE OPERATING CONDITIONS	YOU SAVE THIS % IN PRICE OVER STANDARD 2000-3000 PSI CYLINDERS
1½"	1500 PSI	2500 PSI	27%
2	1500	2500	27%
2½	1000	1500	28%
3¼	1500	2500	32%
4	1000	1500	35%
5	800	1200	37%
6	800	1200	43%
8	500	800	50%
10	500	800	71%
12	500	800	76%
14	500	800	*Not Available in 2000-3000 PSI*

with IDENTICAL seals, design, and safety factors as the famous Miller "Power-Packed" Model "H" Line for 3000-5000 psi service.



SEAL FAILURE MEANS CYLINDER FAILURE!

1. *No seal made of synthetic rubber is compatible with even 50% of available, commercial, petroleum base hydraulic fluids.*

MILLER Uses All Teflon* Seals to Eliminate External Oil Leakage because Teflon is impervious to all known hydraulic fluids, even fire-resistant types.

TEFLON SHEF SEAL At Tubing Ends

No blind assembly. Is
Shear-proof
Heat-proof
Extrusion-proof
Fluid-proof

TEFLON Seals On Piston Rod And Bushing

Teflon rod flange seal requires no adjustment. Teflon bushing seal is shearproof. Teflon wiper keeps dirt out.

TEFLON Seals On Ball Check And Adjusting Screw

Non-protruding, self-locking, cushion adjusting screw interchangeable with ball check for easy access.

MILLER Uses Resin-Impregnated Leather Piston Cup Seals because they are compatible with petroleum base fluids and some fire-resistant types. Teflon cups available at small extra cost.

2. *Nicked or scored piston rods cause seal failure*

MILLER Uses Case-Hardened Chrome-Plated Piston Rods because they prevent nicks, scoring and rust.

NOW! You can save MORE with quality Miller "Job-Rated" Cylinders than with cut-price, lesser quality hydraulic cylinders. And the "Job-Rated" Cylinders are also available under the same immediate shipment program as the Power-Packed Line (2 hours if necessary—3 days normal).

OTHER MILLER QUALITY FEATURES

- Rust-Resistant Surfaces
- Interchangeable, Space-Saving Square, 4-Tie-Rod Design
- Precision Honed Barrels

MILLER FLUID POWER

2008 N. Hawthorne Ave., Melrose Park, Illinois

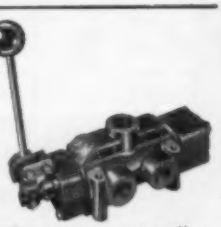
ADEL *Industrial Hydraulic Equipment*

for PEAK PERFORMANCE ADEL Hydraulic Valves and Pumps are setting new and ever higher standards for precision in manufacturing and efficient performance in operation. Following are but a few of the wide variety of models to meet all operating conditions.

GEAR-TYPE HYDRAULIC PUMPS

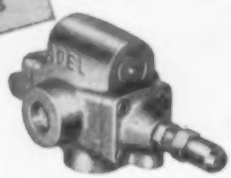
For 1000 psi service with rated capacities at 1800 rpm of from 1.5 to 46.8 gpm.

DIRECTIONAL CONTROL VALVES



4-way valves with spring-centered, spring-offset, and 1, 2, or 3 position detent action. 1500 psi. Flows to 28 gpm.

BY-PASS VALVES



Relief, Sequence and Unloading valves. Direct or remote operation, 50 to 1500 psi range.

VOLUME (FLOW) CONTROL VALVES

Compensated type maintains constant flow over wide differential pressure range. No drain line required. 1500 psi.

PILOT VALVES

2 or 3 position detent. With or without dog or lever. Can be used as 4-way valve in small circuits. 1000 psi.

CHECK VALVES

Valves allow free flow in one direction only. Many variations available. 3000 psi.

Reliability

ADEL PRECISION PRODUCTS

A DIVISION OF GENERAL METALS CORPORATION

HUNTINGTON 4, WEST VIRGINIA

Manufacturers of MARINE & INDUSTRIAL HYDRAULIC CONTROL EQUIPMENT

DISTRIBUTORS:

ARIZONA
Air-Draulics Company
Phoenix, Arizona

CALIFORNIA
Haskel Engineering & Supply Co.
Glendale 4, California
Haskel Engineering & Supply Co.
San Francisco 3, California

CONNECTICUT
Air & Hydraulic Engineering Co.
New Haven, Connecticut

INDIANA
The Neff Engineering Co.
Fort Wayne 3, Indiana

MICHIGAN
Industrial Air & Hydraulic Equipment Company
Detroit 15, Michigan
Hydraulic Equipment Co.
Saginaw, Michigan

MINNESOTA
Ringarud Equipment Co.
Edina Branch
Minneapolis, Minnesota

MISSOURI
Corby Supply Company
St. Louis, Missouri
L. H. Monsees,
Independence, Missouri

NEW YORK
Power Drives, Inc.
Buffalo, New York
Tri-State Supply Company
Brooklyn 33, New York

OHIO
Scott Equipment & Engineering Company
Dayton 10, Ohio
Wyatt Sales Company
Cleveland 15, Ohio

OREGON
Russ Chamberlin Company
Portland 14, Oregon

PENNSYLVANIA
Frank T. Donnelly Company
Pittsburgh 38, Pennsylvania

RHODE ISLAND
Lincoln Supply Company
Pawtucket, Rhode Island

TEXAS
Air-Draulic Equipment Company
Houston, Texas

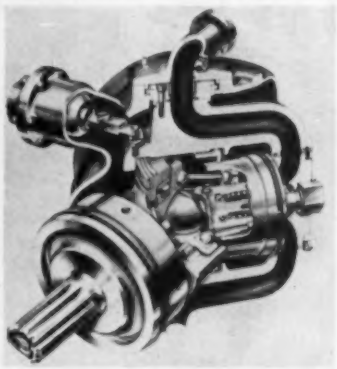
UTAH
Robert Taylor & Sons
Salt Lake City 10, Utah

WASHINGTON
Russ Chamberlin Company
Seattle, Washington

CIRCLE 3 ON READER SERVICE CARD

BRIEFS

The transmission is rated for 4000 psi. An additional gear pump precharges the transmission and resets the main pump swash-plate to zero when the unit is started.



4000-PSI HYDROSTATIC TRANSMISSION has swash-plate type design. As a drive for mobile equipment, transmission eliminates clutch and gear box, and provides power braking on the driven wheels.

Mr. Bound gave a survey of applications of fluid power in many industries, ranging from aviation, in which his experience goes back to early days, agriculture and mining. He discussed hydraulic roof control equipment and pit props for mining, and showed illustrations of self-advancing, roof support gear. ▼▼▼

Air-Oil Tire Handling

Automobile manufacturers have had to develop new methods to install and inflate tubeless tires on the production line. A hydro-pneumatic machine has been designed by the Automation Division of Hymatic Engineering Ltd. enabling an operator to inflate a tire to within 1 psi of the recommended pressure in less than 6 seconds. This machine has two horizontal platens. The top one is hollow for passing the air into the tire, and the lower one has a wide resilient sealing ring.

With the tire loose on the rim the wheel is laid on the lower platen, so that the underside of the wheel rim is sealed by the rubber ring. The operating button

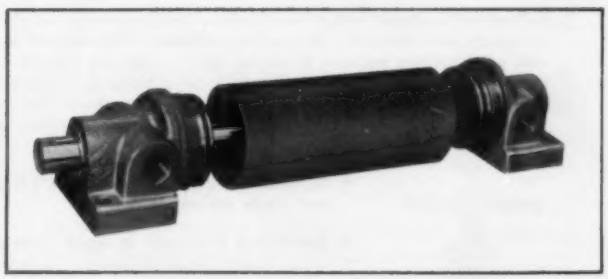
Continued on page 52

BOSS . . . *PLEASE*
NEXT TIME BUY
PATHON CYLINDERS

Does your maintenance man need six arms? He won't if you specify

PATHON CYLINDERS

With* PATHON HYDRAULIC CYLINDERS *the maintenance you save may be your own.



Even the most durable equipment ultimately requires maintenance. When that time comes you continue to get extra advantages with Pathon Cylinders.

The rod packing is externally replaceable. When you disassemble the cylinder you do it so easily — *one piece at a time.* When you reassemble the piston in the barrel — no special tools, or collapsing devices are required.

With Pathon Cylinders you won't need a six armed maintenance man to reassemble an assortment of bolts, nuts, plates, mounting brackets, etc., and no more of this, "Joe, see if you can locate a torque wrench. We have to get this machine running."

Pathon

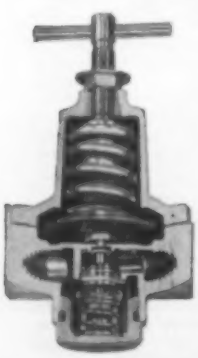
THE PATHON MANUFACTURING CO.
3823 Pacific Ave. Cincinnati 12, Ohio

FACTS about Norgren PRESSURE REGULATORS

Norgren Pressure Regulator on punch press at Shwayder Brothers, Inc., maker of Samsonite Luggage.

Reduce Air Costs... Cut Maintenance Costs

For any air operated equipment, there is one pressure at which it is designed to operate most efficiently. Above that pressure, equipment will wear excessively with no significant increase in output, and compressed air will be wasted. No matter what the application, you can choose a Norgren Pressure Regulator that will reduce line pressure to the desired working pressure. Results will include longer equipment life, lower maintenance costs, less down-time and savings in compressed air costs.



- **Norgren Pressure Regulators are Highly Accurate** over a wide operating range.
- **Regulated Pressure is Held Constant** even with widely fluctuating line pressure and rapidly varying air flow.
- **Flow Capacity is Large**—a. Balanced valve construction; b. Large effective diaphragm area; c. Improved baffle and siphon performance; d. Large passages; e. Large valve openings.
- **Choice of Relieving or Non-Relieving Regulators.**

For complete information on all your regulator needs 1/8" to 2" inclusive, call your nearby Norgren Representative listed in your telephone directory—or WRITE FOR NEW No. 900 CATALOG.

C. A. NORGREN CO.

3402 SOUTH ELATI STREET ENGLEWOOD, COLORADO

BRIEFS

is then pressed and air-pressurized oil brings the top and bottom platens together, squeezing the wheel and tire between them. A sequence valve then locks the platens and opens the air supply valve to the top platen, inflating the tire to a pressure higher than that which is ultimately required.

At this point, a second sequence valve shuts off the air supply and rapidly releases the platen pressure. The effect of this sudden platen release is that the tire *explodes* into position with its edges

OPERATOR LOADS A TIRE on the 3-station transfer machine. At following stations tire is pneumatically rolled onto rim and inflated.

forced firmly against the wheel rims, making an airtight seal. The expansion of air during this explosion reduces the tire pressure to the correct figure, and the wheel is then removed from the lower platen.

Though similar machines are used in the U. S., the British problem was complicated by the necessity of handling various sizes of wheels and tires. The wide sealing ring on the lower platen permits this flexibility.

At the Vauxhall plant in Luton, this machine is incorporated in a pneumatically operated, 3-station, circular transfer machine. At the first station, a wheel and tire are loaded manually with the tire partially over the wheel rim. At the second station, a rotating arm rolls the tire onto the wheel in preparation for inflation. After inflation, the wheel is moved automatically onto a conveyor to the production line.

JOHN A. LANKESTER
European Editor

▼▼▼

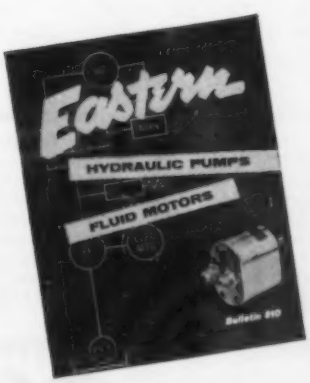
129 Hydraulic Pump and Motor Combinations

Here are power sources for any hydraulic application. Commercial, military, and aviation research have developed this array of standard pump and motor combinations.

With a performance range from .1 to 5 G.P.M. at pressures to 2000 P.S.I., you can expect a stock power source that fits your requirements. Many types of motors offer a choice of electrical characteristics, and have drip-proof, totally enclosed, or explosion-proof enclosures as required.

Typical uses are hydraulic power for machine tools, automatic door openers, material handling equipment, and thousands of other applications requiring smooth, dependable hydraulic power.

When you need custom equipment, call on Eastern and discover how this adaptable line of hydraulic pumps and motors fills the bill without research expense by you.



brand new bulletin ready!

Gives full performance data on pump and motor combinations. Write today for your copy of Bulletin 810-A.

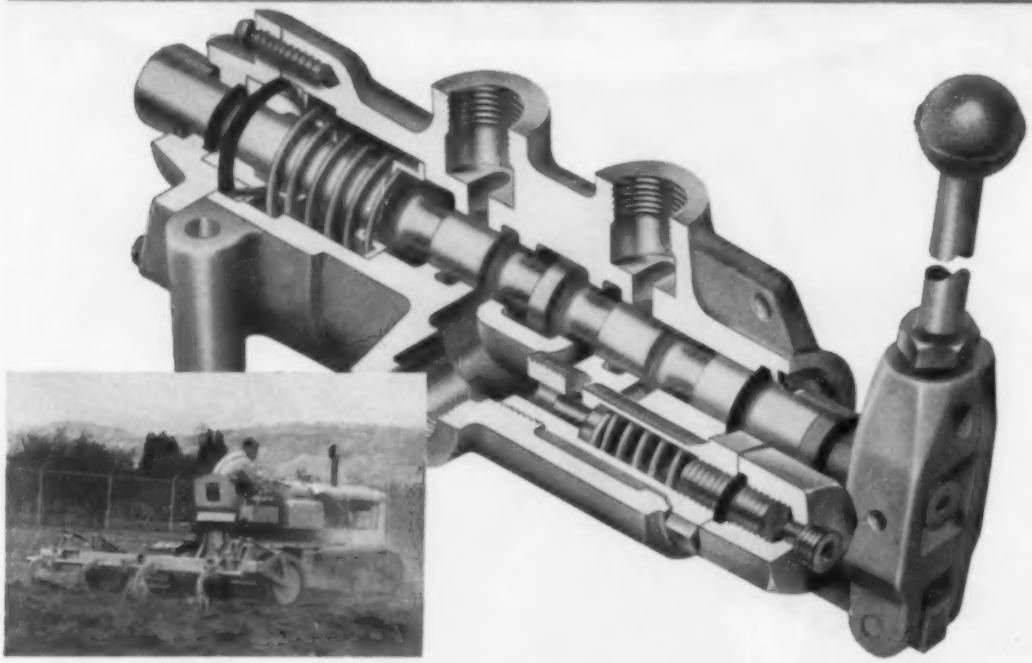
Eastern Industries, Inc.

EASTERN INDUSTRIES PUMP DIVISION

300 SKIFF ST., HAMDEN 14, CONN.

CIRCLE 42 ON READER SERVICE CARD

NATIONAL OIL SEAL LOGBOOK



Use of O-rings as moving seal in heavy duty bulldozer control valve

1,500 psi variation without backup rings. Intermittent operation plus long periods of inactivity. Extreme external dust and dirt conditions. Irregular and unpredictable field servicing. Fluid oil temperatures reaching 180°F. Climatic temperature extremes from —30° to +120°F. Life expectancy is required to be that of the tractor.

Above are the rugged operating conditions faced and met by National industrial O-rings in the new Be-Ge Model SU-1200F bulldozer blade control valve. A total of four rings are employed in each unit; two in a moving shaft application and two as static seals.

Be-Ge reports no leakage or ring failure on hundreds of heavy duty applications involving Oliver, Caterpillar, International Harvester and other crawler tractor installations.

National offers a complete line of industrial O-rings, plus many exclusive compounds. Special compounding is also available to meet unusual conditions.

For complete information on National O-Rings, or for skilled O-ring engineering service, call your nearest National Seal engineer. In major cities nationwide. See the Yellow Pages, under "Oil Seals".

Syntech® Oil Seals

Syntech oil seals, developed by and offered exclusively by National, are widely used synthetic rubber seals for applications where temperatures reach 250°F, speeds reach 3,600 FPM, and total indicator runout is as high as .030. Basic 50,000 series Syntech (illustrated) employs a tough, accurately manufactured steel outer case, precision-tensioned spring and accurately molded and trimmed Syntech sealing lip.

Micro-Torc Oil Seals

Micro-torc oil seals, pioneered by National, are sturdy, dependable leather seals. Special elastomer coating on *surface* of chrome re-tanned leather sealing lip prevents seepage of oil. Yet inner body of sealing lip retains natural porosity to "store" lubricant against accidental periods of starvation. Inherent lubricity of elastomer coating produces a lower torque, longer lasting, economical oil seal. Available in a wide variety of types and sizes.

NATIONAL SEAL
Division, Federal-Mogul-Bower Bearings, Inc.
General Offices: Redwood City, California
Plants: Van Wert, Ohio, Redwood City and Downey, California

4894

CIRCLE 90 ON READER SERVICE CARD

ANNOUNCING!

VICKERS® New ¼" Temperature and Pressure Compensated FLOW CONTROL VALVE

ANOTHER VICKERS FIRST

FOR OPERATING PRESSURES UP TO 2000 psi

For years the Machine Tool Industry has been asking for a combination Temperature and Pressure Compensated Flow Control Valve to insure CONSTANT FEED RATES. Now for the first time it is available as a production unit at a reasonable price.

Check THESE EXCLUSIVE FEATURES that mean Optimum Tool Life and Better Work Finish:

☑ **TEMPERATURE COMPENSATED**
Constant feed rates all day long with same throttle setting because throttle automatically compensates for changes in oil temperature. The compensator mechanism is simple in design and durable.

☑ **PRESSURE COMPENSATED**
Constant feed rate throughout entire cycle because built-in pressure hydrostat automatically compensates for load changes.

☑ **SINGLE THROTTLE COMPLETE RANGE ADJUSTMENT**
Greater flexibility because valve is adjustable within entire flow range of 5 to 1000 cubic inches per minute.

☑ **REVERSE FREE FLOW AS STANDARD FEATURE**
A standard feature which permits reverse free flow (up to 1400 cu. in. per min.) from outlet to inlet port by-passing control elements.

☑ **TAMPER-PROOF ADJUSTMENT**
Retension of original feed rate is assured because a set screw prevents inadvertent throttle movement and a cover over the set screw can be locked in place.

☑ **INTERCHANGEABLE**
This new valve replaces 12 previous models and it is interchangeable with all of them, also the drain connection is eliminated on the new valve to simplify piping.

☑ **GREATER ECONOMY**
No need to stock several valves for wide range of flow rates. Drain connection is eliminated, piping costs are reduced.

☑ **MAXIMUM RELIABILITY AND ACCURACY**
Design of temperature and pressure control components assures maximum circuit reliability and extreme accuracy of feed through a range of 5 to 1000 cubic inches per minute.

FOR ADDITIONAL INFORMATION SEND FOR I-195040 7949

VICKERS INCORPORATED
DIVISION OF SPERRY RAND CORPORATION
Machinery Hydraulics Division
ADMINISTRATIVE and ENGINEERING CENTER
Department 1474 • Detroit 32, Michigan

Application Engineering Offices: ATLANTA • CHICAGO • CINCINNATI • CLEVELAND • DETROIT • GRAND RAPIDS • HOUSTON LOS ANGELES AREA (El Segundo) • MINNEAPOLIS • NEW YORK AREA (Springfield, N. J.) • PHILADELPHIA AREA (Media) • PITTSBURGH AREA (Mt. Lebanon) • PORTLAND, ORE. • ROCHESTER ROCKFORD • SAN FRANCISCO AREA (Berkeley) • SEATTLE ST. LOUIS • TULSA • WORCESTER
FACTORIES ALSO IN AUSTRALIA, ENGLAND, JAPAN AND GERMANY
IN CANADA: Vickers-Sperry of Canada, Ltd., Toronto, Montreal and Vancouver

ENGINEERS AND BUILDERS OF OIL HYDRAULIC EQUIPMENT SINCE 1921

CIRCLE 136 ON READER SERVICE CARD

Tubexperience in action

Your carbon hydraulic tubing with Superior

gets 100% permanent protection rust preventive!

*Superior (SAE) Carbon Hydraulic gives you the smoothest, most brilliant ID and OD finish you can buy. Made from non-aging steel. Carbon content is only .12% maximum for high ductility. Every length is 100% hydrostatically tested. You get maximum performance and minimum turbulence, plus long service life.

You get all this, *plus one important extra that makes Superior hydraulic tubing your best investment—a rust preventive that gives 100% positive protection indefinitely!*

Just dip it and use it! Superior rust preventive comes off easily, leaves tubing clean and bright, just like new.

GET EXTRA SAFETY WITH SUPERIOR

There is a reason for use of the special rust preventive on Superior hydraulic. Thin oil coatings are not sufficient protection. They will bleed or rub off—and when the tubing is to be used, it shows patches of rust and pin spots where pitting has begun. The tubing no longer meets specifications, because that marred ID is sure to cause pressure trouble and excessive turbulence. But the high protection you get when you buy Superior hydraulic assures you of tubing that is always ready for service, weeks or months after you buy it.

Each length of Superior hydraulic tubing gets an all-important coating of rust preventive. This microcrystalline wax material sheathes the tube in an unbroken film inside and outside. It sets quickly, will not run or rub off during shipment, is not slippery or messy to handle, will not bleed over your storage racks. Tubing is safeguarded against rusting, corroding, staining or tarnishing in damp or corrosive atmospheres.

EASILY REMOVED

The rust preventive can be removed as simply and quickly as lighter, less efficient coatings. Simple immersion for a 5-minute maximum in any of a variety of standard cleaners (Stoddard, kerosene, cleaning solvents such as trichloroethylene, or commercial alkali cleaners) is sufficient.

A REMINDER

Remember—normally you buy your tubing from a distributor (a steel service center). To give you the best possible service, he must stock carbon hydraulic in his racks. It may be there a month or two—even longer. But if you specify Superior (SAE) Carbon Hydraulic, you know it will reach you as bright and shiny as the day it was drawn. Just dip it and use it!

Superior hydraulic tubing is available through leading steel service centers from coast to coast. For the name of your local Superior Tube distributor and a free copy of Bulletin 39, write to Superior Tube Company, 2030 Germantown Ave., Norristown, Pa.

Superior Tube

THE BIG NAME IN SMALL TUBING

NORRISTOWN, PA.

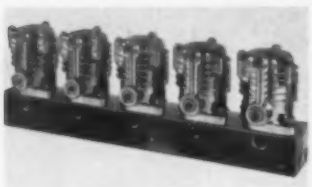
All analyses .010 in. to ⅝ in. OD—certain analyses in light walls up to 2½ in. OD.

West Coast: Pacific Tube Co., 5710 Smithway St., Los Angeles 22, Calif. • RAymond 3-1331

NEW PRODUCTS

...uipment for fluid power systems. For
...d mail post card bound in this issue.

MANIFOLDED AIR VALVES . . . simplify piping



Features: Manifolds of aluminum alloy bar stock provide common inlet and exhaust passages and individual cylinder ports. Assemblies are available in two, three, four and five station types with either three way normally open or normally closed solenoid valves, in unmixed groups.

Specifications: Capacities range up to 2.0 cfm air and 0.5 gpm hydraulic. Cylinder ports are ¼" NPT and manifold ports are ½" NPT. Solenoid coils, for ac or dc, any voltage, are guaranteed against burnout for the life of the valve.

Valvair Corporation
Akron, Ohio
CIRCLE 300 ON READER SERVICE CARD

FLUID POWER CYLINDER . . . meets automation standards

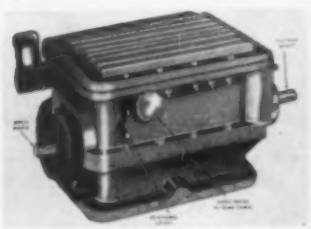
Designation: Series "S2"

Features: Nine bore sizes ranging from 1½" to 8" and 11 standard mountings are available. The three piston rod end styles are: large external thread, small external thread with shoulder and internal thread.

Specifications: Cylinders are rated at 1000 psi hydraulic, 200 psi air, and for non-shock load up to 1500 psi hydraulic. All cylinders in the line meet JIC specifications.

Hydro-Line Manufacturing Co.
Rockford, Illinois
CIRCLE 301 ON READER SERVICE CARD

HYDRAULIC SPEED REDUCER . . . permits fast reversing



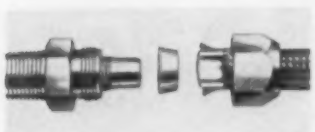
Features: Unit is driven by a ¼ to 1½ HP motor and gives variable speed in either direction of rotation. Reversing is independent of speed control and effortless; can be used for applications requiring continuous reversing. Speed selection is obtained by rotation of hand wheel.

Design: consists of a variable displacement pump driving a fixed displacement hydraulic motor with a recommended maximum input speed of 750 RPM. Adjustable relief valve is preset at factory for 100 in. lbs. of torque and may be reset up to 180 in. lbs.

Specifications: Input and output shafts are ⅜ in. dia. with standard keyway. Unit is 11" long, 7½" high, and weighs 32 lbs.

Roberts Electric Co.
Chicago Ill.
CIRCLE 302 ON READER SERVICE CARD

TEFLON HOSE ASSEMBLIES . . . with reusable fittings



Designation: Springfield "140"

Features: Tubing has inner core of Teflon reenforced with stainless steel wire braid. Hose is chemical and corrosion resistant in a temperature range of −100° to +500° F. Fittings are reusable and are readily attached to hose. Fittings consist of: compression nut, nipple insert and tapered ring. Nipple insert is stainless steel. Rings are cadmium plated. Available in sizes from ¼ to ¾ inch and include JIC and S.A.E. fittings.

Titeflex Incorporated
Springfield 4, Mass.
CIRCLE 303 ON READER SERVICE CARD

Continued on page 61

"Pump and Valve life increased many times"

by installing **MARVEL** *Synclinal* **FILTERS**

PIPPIN Excavator and PIPPIN Angling Bulldozer

Pippin Construction Equipment, Inc. (Manufacturers) White River Junction, Vt. advise that—
"Originally the PIPPIN Excavator was not equipped with a filter. Due to this, excessive pump, valve and cylinder wear was experienced. Since installing the Marvel Synclinal Filter, pump and valve life has been increased many times. Of utmost importance is the fact that customers are better satisfied and maintenance has been reduced to a minimum."

OVER 800 other Original Equipment Manufacturers are installing MARVEL SYNCLINAL FILTERS as Standard Equipment!

For Dependable Protection on Your Hydraulic and other Low Pressure Systems— investigate MARVEL SYNCLINAL FILTERS

Balanced, Synclinal design is the answer to the growing preference for Marvel Filters to assure maximum protection of equipment—and maintaining the greatest degree of cleanliness of hydraulic oils, fire-resistant hydraulic fluids, coolants, lubricants and water.

THEY MEET J. I. C. STANDARDS

EASY TO CLEAN

Another outstanding feature of Marvel Synclinal Filters is the fact that they can easily be disassembled, thoroughly cleaned and reassembled in a matter of minutes. Thus—"down time" for filter maintenance is reduced to the absolute minimum. Line type operates in any position and may be serviced without disturbing pipe connections.

A SIZE FOR EVERY NEED
Easy To Install

Marvel Synclinal Filters are easy to install in sump or on line preceding pump. Both sump type and line type models are available in capacities from 5 to 100 G. P. M. Monel mesh sizes range from coarse 30 to fine 200.

IMMEDIATE DELIVERY

Our catalogs contain complete engineering data and dimensional charts of all models and sizes. You can order a filter to meet your specific requirements and get IMMEDIATE DELIVERY.

SUMP TYPE (cutaway)

LINE TYPE (cutaway)

VISIT OUR EXHIBIT

Booth No. 956

1958 Design Engineering Show

International Amphitheatre

Chicago, Ill. APRIL 14-15-16-17

MARVEL ENGINEERING COMPANY

7227 N. HAMLIN AVE.,
CHICAGO 45, ILLINOIS
Phone: JUNIPER 8-6023

Without obligation, please send me complete data on Marvel Synclinal Filters, as indicated: (AH-3)

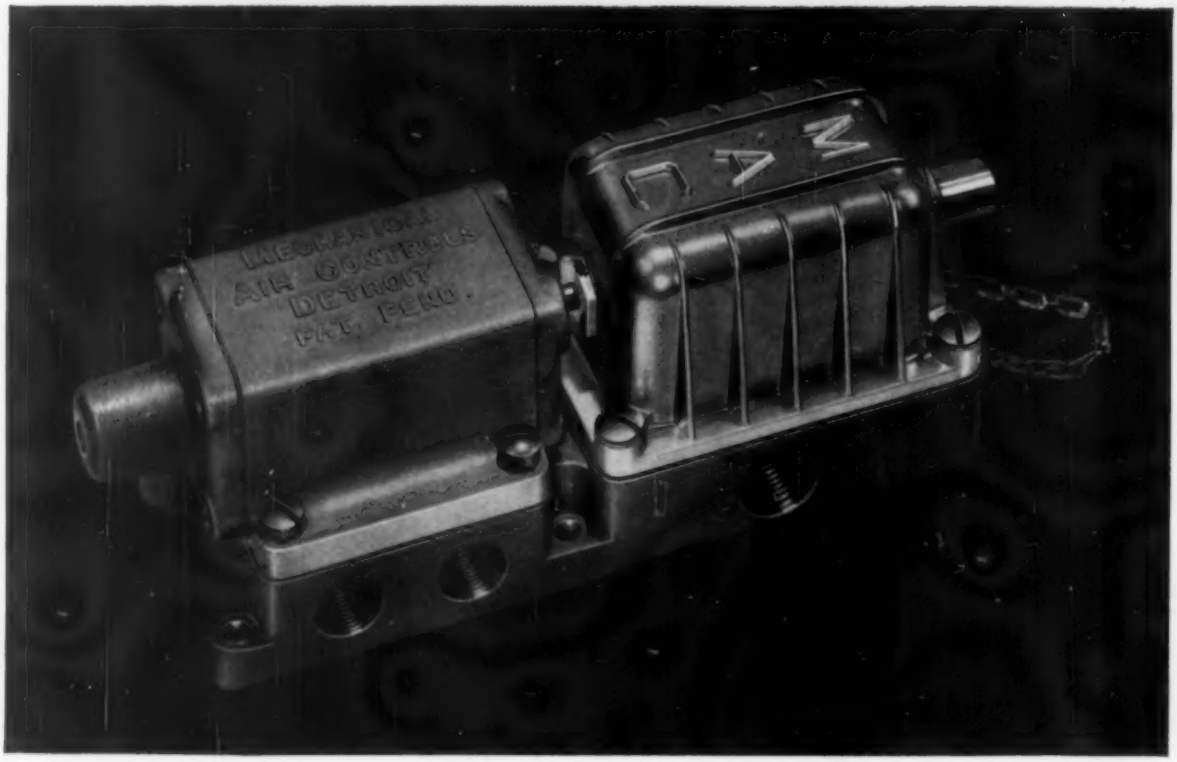
- ☐ Catalog #100—For Hydraulic Oils, Coolants, Lubricants
- ☐ Catalog #200—For Fire-resistant Hydraulic Fluids (Aqueous Base)
- ☐ Catalog #400—For Fire-resistant Hydraulic Fluids (Synthetic)
- ☐ Catalog #301—For Water

Name _____ Title _____

Company _____

Address _____

City _____ State _____



When is an air valve truly J.I.C.?

Only when it meets *all* J.I.C. requirements. To our knowledge this new MAC series *alone* can pass the test completely.

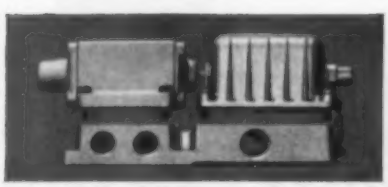
Example #1. It is the only valve with completely independent body and solenoid. Either can be removed separately from the base without disturbing the other. This eliminates confusion of responsibility between electrical repair and mechanical repair . . . greatly simplifies maintenance and repair.

Example #2. Cover assembly contains a manual overide operator which includes a "lock-in" position for safety. Cover is dust-proof, splash-proof, chained to base. Solenoid is inoperative when cover is removed.

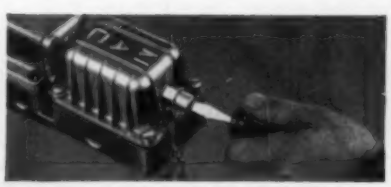
Example #3. The base contains an integral conduit box with threaded conduit connections. Ample space . . . easier wiring . . . more compact valve.

Extra features in this J.I.C. series include the MACsolenoid. It is positively shock-resistant mounted . . . has no metal-to-metal contact with stationary parts . . . by actual test operates nonstop and *without any failures* millions of cycles longer than other solenoids.

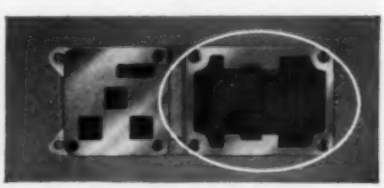
Compare this new MAC series with any other "J.I.C." valve. They alone meet *or surpass* every J.I.C. specification. They are typical of the engineering excellence you find in all MAC valves. For information call a MAC representative listed at the right, or write direct.



1 Independent body, solenoid, base



2 Safe, manual overide operator



3 Integral conduit box in base

MECHANICAL AIR CONTROLS, INC.
10030 Capital, Oak Park, Detroit 37, Michigan

MAC

CIRCLE 84 ON READER SERVICE CARD

PHONE YOUR NEARBY "MAC" REPRESENTATIVE FOR DATA AND DELIVERY

ARKANSAS
Branch-Merwin Tool Specialists, 477 N. Bellevue, Memphis 5, Tenn., BRoadway 8-6102

CALIFORNIA
OAKLAND 8—The Rucker Co., 4700 San Pablo Ave., OLympic 3-5221
SOUTH GATE—The Rucker Co., 4956 Firestone Blvd., LOrain 4-2521

FLORIDA
MIAMI SPRINGS—Aero Hardware & Supply Inc., 4301 Northwest 36th St., TUxedo 8-2414

ILLINOIS AND IOWA
CHICAGO 6—Walter Norris Engineering Co., Civic Opera Bldg., 20 N. Wacker Dr., STate 2-2804

INDIANA
EVANSVILLE 14—Neff Engineering Co., 2509 Washington Ave., GReenleaf 7-4141
FORT WAYNE 3—Neff Engineering Co., Station A, P.O. Box 2001, 2339 Crescent Ave., EAstbrook 7391
INDIANAPOLIS 2—Neff Engineering Co., 1955 Central Ave., WAlnut 5-5311
SOUTH BEND—Neff Engineering Co., 707 South Eddy St., ATlantic 7-5655

MARYLAND (and Dist. of Columbia)
BALTIMORE 18—N. B. Cochrane Co., 100 E. 20th St., HOpkins 7-4884

MASSACHUSETTS (and New England)
BOSTON 34—Electrical Apparatus Co., Inc., 1200 Soldiers Field Rd., STadium 2-7440

MICHIGAN
BAY CITY—Fred Kober, 506 So. Chilson St., TWinbrook 2-2629
FLINT 2—Kober Sales Engineering Co., 1115 Root St., CEdar 2-7165
WESTERN MICHIGAN—Everett Adams, 17212 Sharon Road, Chesaning, Michigan, VIctor 5-3446

MINNESOTA
MINNEAPOLIS 8—Air & Hydraulic Equipment Co., 15 E. 38th St., TAylor 3-6118

MISSISSIPPI
Branch-Merwin Tool Specialists, 477 N. Bellevue, Memphis 5, Tenn., BRoadway 8-6102

MISSOURI
ST. LOUIS COUNTY—Oscar E. Jost Co., P.O. Box 6, St. Ann, HArrison 8-4488

NEW JERSEY
(NORTHERN) Machinery & Machine Supplies Co., Inc., 305 East 47th St., New York 17, New York, PLaza 8-0744
(SOUTHERN) Automation Aides, 1618 Willow Ave., Philadelphia 26, LaMott, Pennsylvania, MElrose 5-5555

NEW YORK
BUFFALO 25—C. H. Tepas Co., 137 Lamarck Drive, Circle 3210
NEW YORK 17—Machinery & Machine Supplies Co., Inc., 305 East 47th Street, PLaza 8-0744

OHIO
CINCINNATI 2—Fluid Power Engineering Co., 205 Keith Bldg., MAin 1-6640
CLEVELAND 9 (PARMA)—Fluid Power Engineering Co., 5451 Broadview Rd., FLorida 1-1199

OREGON
PORTLAND—The Rucker Co., 911 N. W. Hoyt St., CApitol 3-0205

PENNSYLVANIA
PHILADELPHIA 25, LaMOTT—Automation Aides, 1618 Willow Ave., MElrose 5-5555
PITTSBURGH—Machinery & Machine Supplies Co., Inc., 1307 Rutherford St., LEhigh 1-1235

TENNESSEE
MEMPHIS 5—Branch-Merwin Tool Specialists, 477 N. Bellevue, BRoadway 8-6102

TEXAS
DALLAS 35—Womack Machine Supply Co., 2010 Shea Road, FLeetwood 7-3871

WASHINGTON
SEATTLE—The Rucker Co., 1000 4th Ave., South, MAin 2783

WISCONSIN
MILWAUKEE 17—Neff Engineering Co., 5856 No. Pt. Washington Rd., Edgewood 2-1579

CANADA
MONTREAL—L. S. Tarshis & Sons, Ltd., 450 McGill St., Quebec, PLateau 2963
TORONTO—Trevor Babbs, National Time & Signal Co., 72 Shilton Rd., Agincourt, Ontario, OXford 1-4857

MECHANICAL AIR CONTROLS, INC.
DETROIT 37, MICHIGAN
MAC

NEW PRODUCTS

COUNTER

. . . connects to hydraulic line

Designation: Model SEH

Features: Automatic counting device was designed for any operation controlled by hydraulic action. The

unit easily connects into a line powering a hydraulic cylinder on a machine tool. Registers up to five digits at rates up to 300 counts per minute. Available in either knob or "tamperproof" key reset, for pressures from 50 to 8000 psi. Snap on attachments are available so that counters can be turned in at shift changes for tabulation.

Pneumaticount
Portland, Oregon

CIRCLE 304 ON READER SERVICE CARD

FOOTLESS VARIDRIVE

. . . for easy mounting

Designation: Type VEV

Application: Unit is suitable for heavy industrial duty in turbine pumps, mixers, etc.

Features: Footless variable speed motor features, quick, accurate alignment to the driven equipment. Castings are specially heat-seasoned to remove internal stresses and prevent distortion. Windings are asbestos protected to resist heat and moisture.

Specifications: Available in ¼ to 30 H.P. in ratios up to 10:1 and can be furnished with automatic control or remote controls of the mechanical or electrical type.

U. S. Electrical Motors Inc.
Los Angeles 54, Calif.

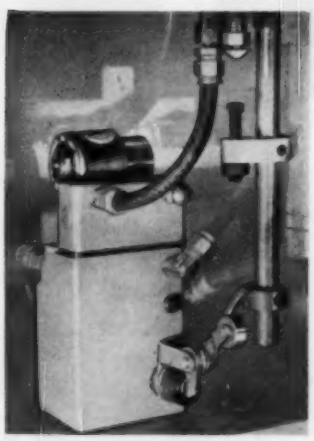
CIRCLE 305 ON READER SERVICE CARD

4-WAY PILOT AIR VALVE

. . . with remote return poppet

Designation: Control-Pac

Features: The unit includes a pilot-operated slide valve, a remote return control throttling valve, electrical junction box with provision for air silencer, and uses either electric or pneumatic initiation. The exhaust port has a throttling valve to control the flow rate. The valve



is shifted by venting a chamber at either end of the activating cylinder with a poppet valve or a straight-away solenoid pilot valve. Electrical circuits are 110 volts.

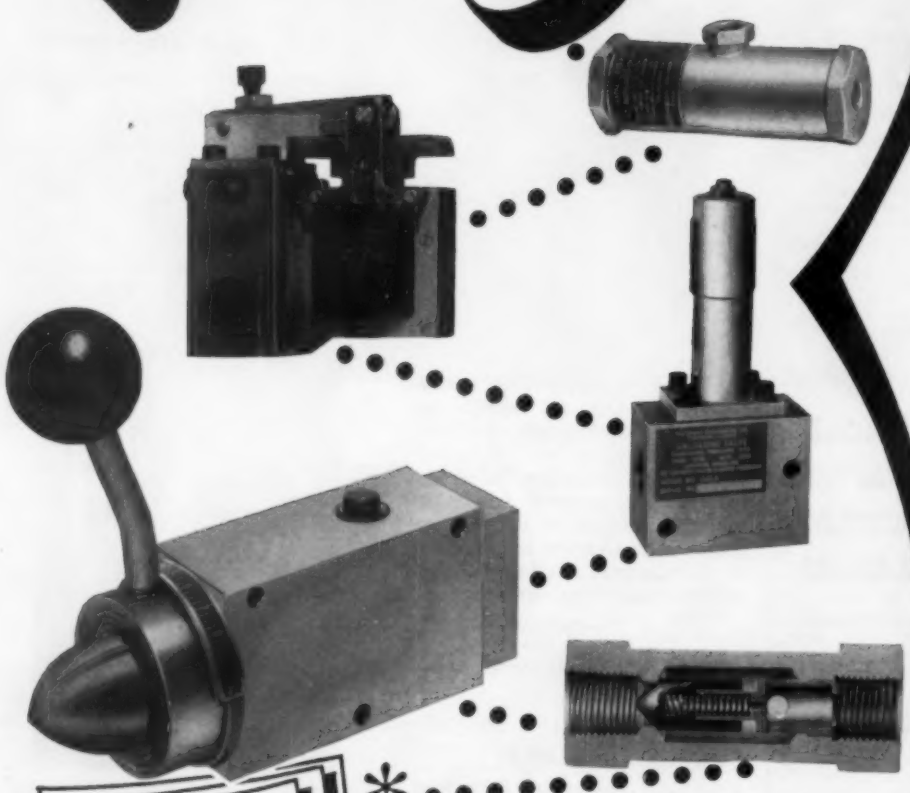
Application: Valve provides automatic advance and retraction of double-acting cylinders, with adjustable dwell time and speed control.

Dixon Automatic Tool, Inc.
Rockford, Ill.

CIRCLE 306 ON READER SERVICE CARD

For more NEW PRODUCT reviews turn to page 133

*progress



WATERMAN PRODUCTS

Adjustable Flow Regulators range from 0.5 GPM to 20 GPM. Constant rate of flow.

Solenoid Valves—inexpensive, compactly built units for hydraulic systems handling non-corrosive fluids.

Unloading Valves for pressures to 3000 psi. Flow rates to 30 GPM. Fast acting.

Check Valves one piece—Nylon Poppet — aluminum body—low pressure drop.

Micronic Line Filters operating pressures to 3000 psi, 40 micron filtration, replaceable elements.

Send for these FREE BULLETINS

WATERMAN ENGINEERING COMPANY

has made great progress in the development of Solenoid Valves, Flow Regulators, Check Valves, Unloading and other valves for safe dependable controls.

These Waterman products are known throughout the industrial world for their accuracy, dependability and low maintenance cost. Their acceptance is best shown by the increasing number of plants that are using these controls.

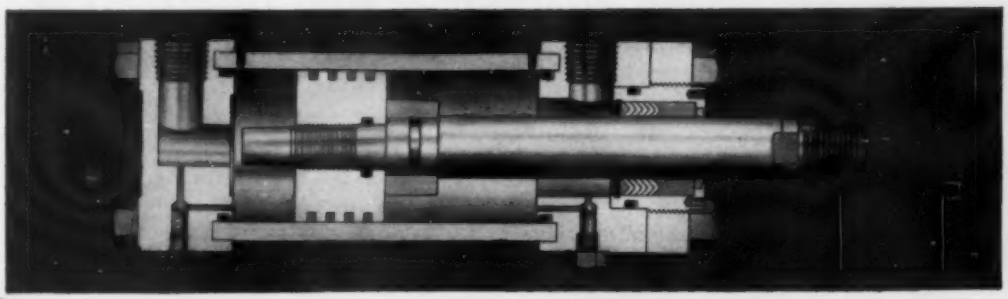
Suppliers of AN and MS qualified Flow Rate and Volume Controls to Aircraft Industry.

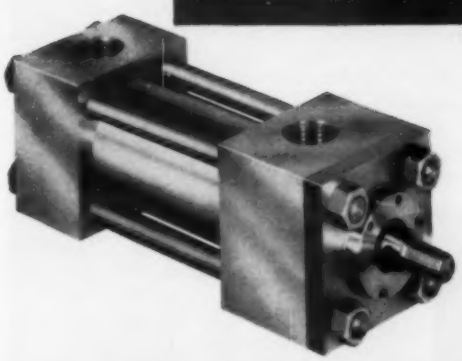
WATERMAN ENGINEERING COMPANY

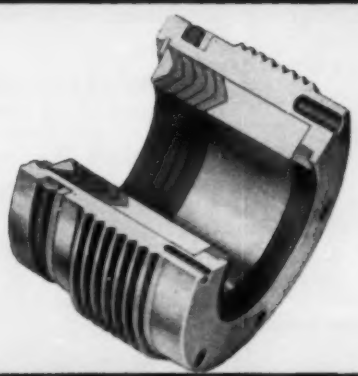
725 CUSTER AVENUE — EVANSTON, ILLINOIS

CIRCLE 141 ON READER SERVICE CARD

O-M a Power-Full Idea in High Pressure Hydraulic Cylinders







O-M *Series TH*
Heavy Duty Hydraulic Cylinders 2000 PSI Shock Loads 3000 PSI Non-shock Loads Meet JIC Standards

Tested, tried and proved powerful components in today's fast-moving automation picture, these ruggedly constructed O-M Heavy-duty Hydraulic Cylinders breeze through heavy work loads, withstand shocks and strains, and provide smooth, dependable power for a wide range of pressures and operating conditions.

Important design and construction features:

1. Head Seal—"O" Ring with leather back-up washer assures positive seal between head and tube.
2. Heads confine tubing O.D. to prevent breathing and thereby provide additional insurance against leakage under the most severe conditions.
3. Heads are counterbored to pilot in accurately honed tubing to assure perfect alignment.
4. Multiple lip, self-compensating, Vee type rod gland packing.
5. Step-cut ring type pistons are standard, but Vee type pistons are available for holding application.
6. Rod gland cartridge is removable for easy maintenance.

O-M Series TH High Pressure Hydraulic (oil) Cylinders are available in full range of sizes (1½" to 8" bores) with standard and heavy duty piston rods.

Mail Coupon TODAY for Bulletin 105 showing descriptive drawings of cylinders, mounting accessories and capacity chart.

ORTMAN-MILLER MACHINE COMPANY
1 143rd Street, Hammond, Indiana

☐ Have representative call
☐ Send Bulletin 105

Name_____ Position_____

Company_____

Address_____

City_____ Zone____ State_____

CIRCLE 94 ON READER SERVICE CARD

USEFUL LITERATURE

For your free copy of publications reviewed, fill in the reader service card

PNEUMATIC INSTRUMENTS . . . for process control are discussed in Catalog #510 of *United States Gauge, Sellersville, Pa.* The devices covered are: indicating controllers for automatic control of pressure or temperature, transmitters for pressure or temperature indication, receiver gauges in various designs, ranges and degrees of accuracy and sensitivity.

CIRCLE 400 ON READER SERVICE CARD

HYDRAULIC MOTOR . . . specification chart is available from *Gerotor May Corporation, Owings Mills, Maryland.* Chart gives data on torque and flow on series MH motors. The motors are of fixed displacement and can be operated at speeds up to 2000 rpm.

CIRCLE 401 ON READER SERVICE CARD

ROTARY AIR COMPRESSORS . . . are illustrated in a booklet published by the *Kellog Division of American Brake Shoe Co., New York, N. Y.* Information gives principle of operation, special features, and operating and mounting specifications.

CIRCLE 402 ON READER SERVICE CARD

FOUR WAY VALVES . . . in a variety of manually operated configurations are described in a 12 page catalog offered by *Rivett, Inc., Boston, Mass.* Specifications pertaining to each operation and mounting style are shown along with a cross-sectional view and illustration of each model. The styles include: pipe and flange connected and sub-plate mounted valves; lever, cam or foot operation.

CIRCLE 403 ON READER SERVICE CARD

HYDRAULIC CYLINDERS . . . for 2000 psi service are described in *Oilgear Co.'s, Milwaukee, Wisconsin,* Bulletin 71000 and DS-71006. Construction features are presented as well as complete installation dimensions on cylinders with five different mounting projections.

CIRCLE 404 ON READER SERVICE CARD

HEAT EXCHANGERS . . . Bulletin 1.1K6 is offered by Ross Heat Exchanger Division of American Standard. Principal design features

are described and illustrated. Specification pages give details of the 46 sizes in one, two and four pass designs. Information on modifications for special conditions is also included.

CIRCLE 405 ON READER SERVICE CARD

HYDRAULIC FLUIDS . . . Bulletin No. 1300SA, "Selection, Operation and Maintenance of Hydraulic Fluids for Industrial Machinery", published by *Vickers Inc., Detroit, Mich.,* is complete, compact and convenient to use. It should cure a lot of headaches for maintenance men who deal with hydraulics. The 24 page booklet describes the characteristics both desirable and undesirable of petroleum base and fire-resistant hydraulic fluids . . . tells how to select the best fluid for a given job, how to care for it, and what to do about trouble when it occurs. The page devoted to trouble shooting tips should be particularly helpful.

CIRCLE 406 ON READER SERVICE CARD

BEARING UNITS . . . Catalog BU-101-A, issued by *Browning Mfg. Co., Maysville, Ky.,* illustrates and describes a new line of pillow blocks and flange blocks. 28 sizes fit 1/2 to 2 7/16 in. shafts; units have malleable housings, self-aligning ball bearings. The 11 page brochure includes specifications, list prices and drawings of the line.

CIRCLE 407 ON READER SERVICE CARD

POWER CYLINDERS . . . described as the Rovalve line of heavy duty Air and Low-Pressure Hydraulic Cylinders are specified in a new catalog offered by *W. G. Rovang and Associates, Inc., Portland, Oregon.*

CIRCLE 408 ON READER SERVICE CARD

SILICONES . . . 150 of them, from adhesives to lubricants to water repellents are described in a 16 page, illustrated booklet from *Dow Corning Corp., Midland, Mich.* Contains detailed charts, tables, graphs and data on properties and performance, with illustrated examples on how silicones can cut costs and simplify design.

CIRCLE 409 ON READER SERVICE CARD

For more reviews of FREE LITERATURE turn to page 146

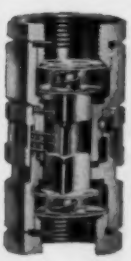
*Snap-Tite

QUICK-CONNECT
QUICK-DISCONNECT COUPLINGS

in larger sizes

immediate delivery
FROM FACTORY STOCKS

Snap-Tite's "H" Couplings are now factory-stocked for quick shipment to you, not only in the smaller sizes (below 1" ID) but in all sizes up to and including 3"—in steel, brass, aluminum, and 303 and 316 Stainless Steel. And "H" Couplings can be made to your order, up to 10" ID.



Available with valves to give two-way or one-way automatic line shut-off, or without valves for straight-thru flow, "H" Couplings are built to handle high pressures in hydraulic and air systems.

Recessed valve washers . . . fluted valve stems . . . valve stops with minimum flow restrictions . . . large inside diameter—allow maximum flow capacity with lowest pressure drop.

See the Snap-Tite representative in your city or write for Bulletin 240.

SNAP-TITE'S "H" COUPLING, SIZE FOR SIZE, IS THE SMALLEST COUPLING WITH HIGHEST STRENGTH AND HIGHER EFFICIENCY

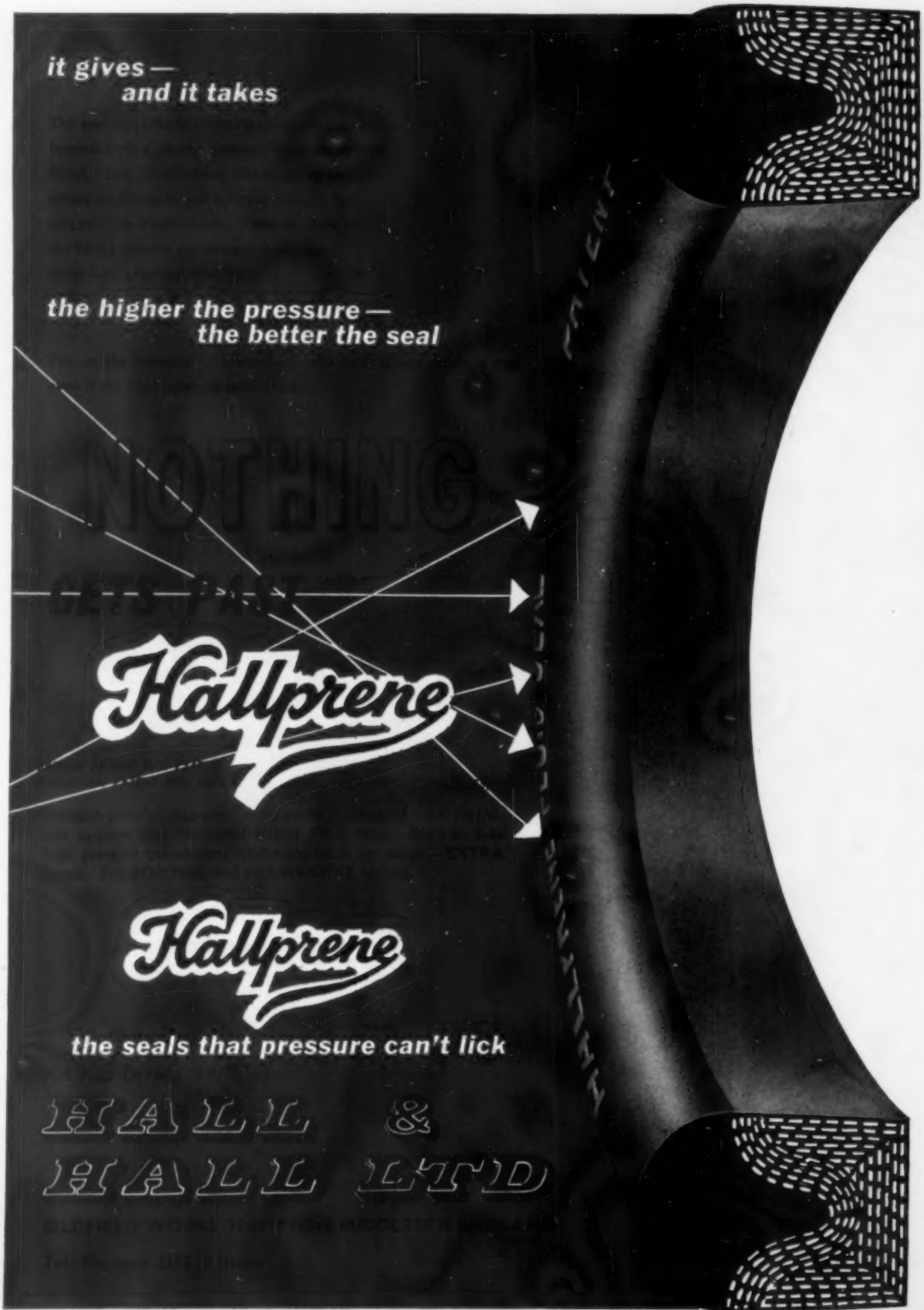
*Snap-Tite, INC.
UNION CITY 1, PENNSYLVANIA

SNAP-TITE COUPLINGS CAN HANDLE ALMOST ANYTHING THAT FLOWS

CIRCLE 117 ON READER SERVICE CARD

it gives—
and it takes

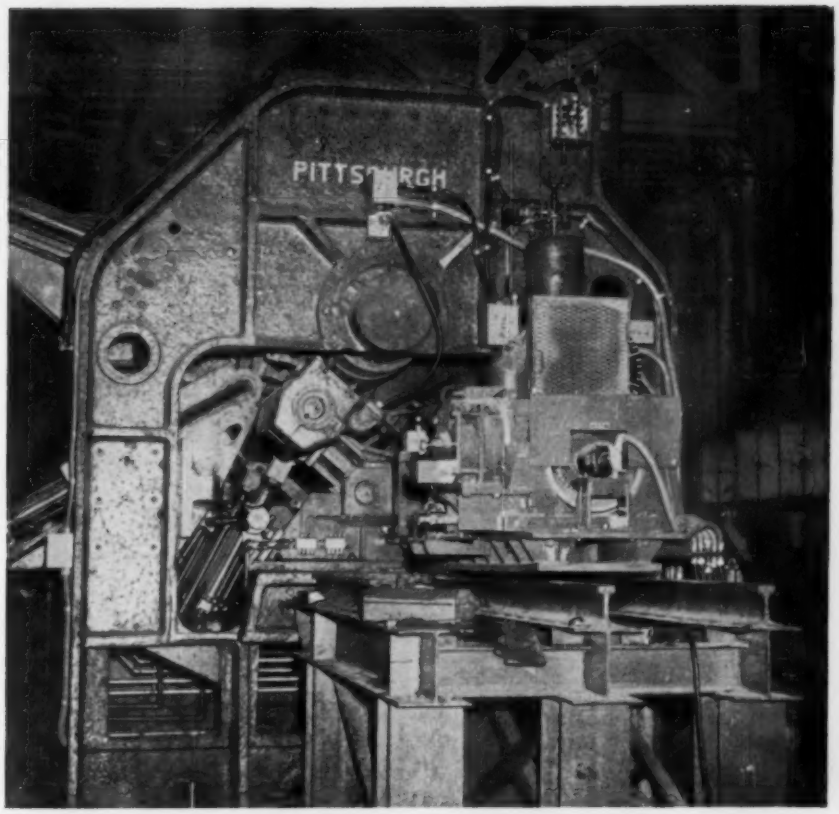
the higher the pressure—
the better the seal



the seals that pressure can't lick

HALL & HALL LTD

P4309



Designed and built by Pittsburgh Engineering and Machine Company for Detroit Steel Corp., Portsmouth, Ohio.

This is HEAVY-DUTY SERVICE!

Pictured here is a coiler which takes hot steel strip as it comes from the rolling mill at 1500 feet per minute, and winds it on a mandrel to produce a tightly and evenly wound coil measuring up to 48" wide, 59" in diameter, and weighing about 20,000 pounds.

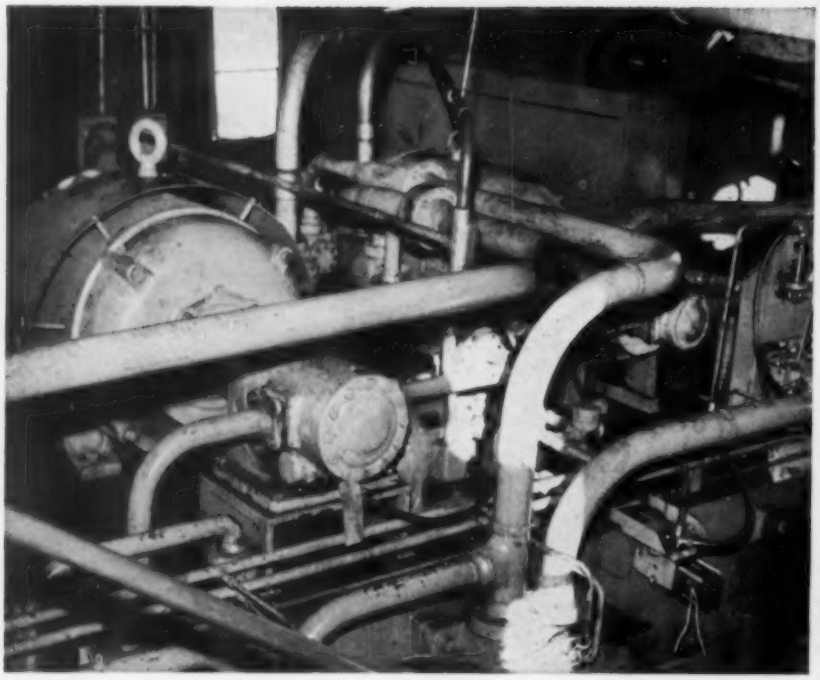
Various parts of the machine essential to winding and handling the coil are hydraulically operated by equipment designed and built by Benjamin Lassman & Son. The high pressure hydraulic control system, engineered by Lassman, provides smooth, shockfree, leakproof operation.

This installation illustrates the high quality of Lassman Hydraulic engineering and equipment so essential to applications such as this which demand the ultimate for continuous, trouble-free performance.

We build Hydraulic equipment for heavy-duty service to your requirements. Let us help you solve your hydraulic problems, assuring you of complete dependability.

Quality EQUIPMENT for *Quality* PERFORMANCE

BENJAMIN LASSMAN & SON | Route 8, GLENSHAW, PA.



Crane lifts junk auto body . . .

To be compressed into metal bundle . . .

"The right hydraulic oil can boost a system's power. See how it boosted ours"

—says Plant Superintendent Pope, Superior Iron & Metal Company, Jacksonville, Florida

Lowers it into Harris baling press.

Two years ago Superior's 445-ton Harris press suffered power loss. Its pump was not delivering full pressure. Tests showed the oil had thinned out.

"So we called in the Texaco Lubrication Engineer," says Superintendent Pope, "and he recommended Texaco Regal Oil R&O. The press now works a 70-hour work week—and has been, ever since we switched to Texaco Regal Oil R&O. Pressure, power and performance remain consistently outstanding."

Texaco Regal Oil R&O makes an ideal hydraulic fluid because it is rust and oxidation-inhibited. It keeps itself and hydraulic systems clean—free of rust, sludge and foam. Its viscosity remains dependably constant.

A Texaco representative can quickly show you the Texaco Regal Oil R&O that is designed for your hydraulic circuit. Call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write:

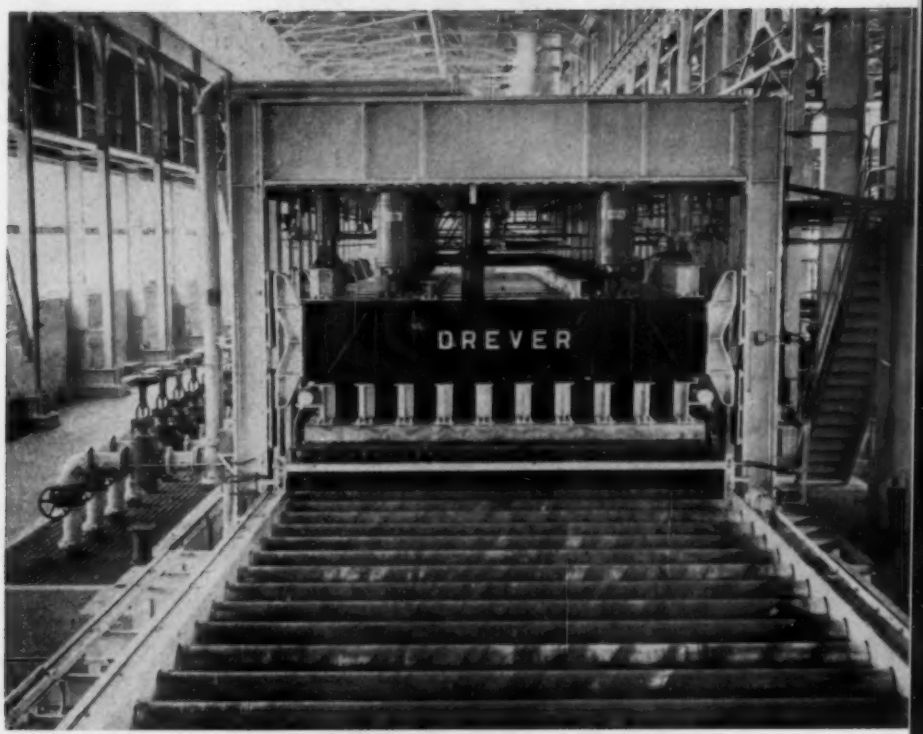
The Texas Company, 135 East 42nd Street, New York 17, New York.

TUNE IN... Metropolitan Opera Radio Broadcasts Every Saturday Afternoon

LUBRICATION IS A MAJOR FACTOR IN COST CONTROL

(PARTS, INVENTORY, PRODUCTION, DOWNTIME, MAINTENANCE)

CIRCLE 125 ON READER SERVICE CARD



ARRANGEMENT OF PLATEN CYLINDERS is shown in this view which also shows equalizing cylinders at two corners. Small tanks mounted on top of the frame supply prefill fluid to the 26 cylinders. Platen lowers by gravity, and is raised by applying pressure fluid to 8 cylinders.

Equalizer circuit levels a 675-sq. ft. platen

• By N. K. Willis
Chief Engineer, Drever Co.
Bethayres, Pa.

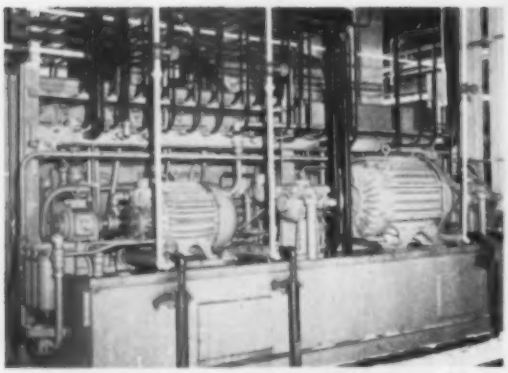
John Williams, Jr.
Hydraulic Engineer
Walter A. Rankin Co.
Drexel Hill, Pa.

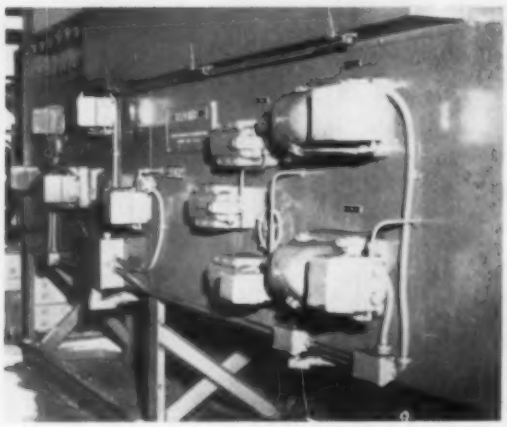
A PRESS platen 15 x 45 ft. in area is something unusual, and so are the problems in keeping it level through its 18-inch travel. Used in a plate-quench operation in a steel mill, the press can exert force on any combination of three areas.

In addition to 26 cylinders for exerting force on the moving platen of the plate quench press, two equalizing cylinders are installed at each corner of the platen to maintain it level. These cylinders are interconnected in closed, series circuits to prevent unequal movement during the stroke of the press. A series of simple check valves and pilot-operated check valves permits a pressure-compensated pump to supply make-up fluid, if necessary to equalize the system after the upstroke of the press and before the succeeding cycle.

APPLICATION

The hydraulic equipment was designed by Drever Co., Bethayres, Pa. and

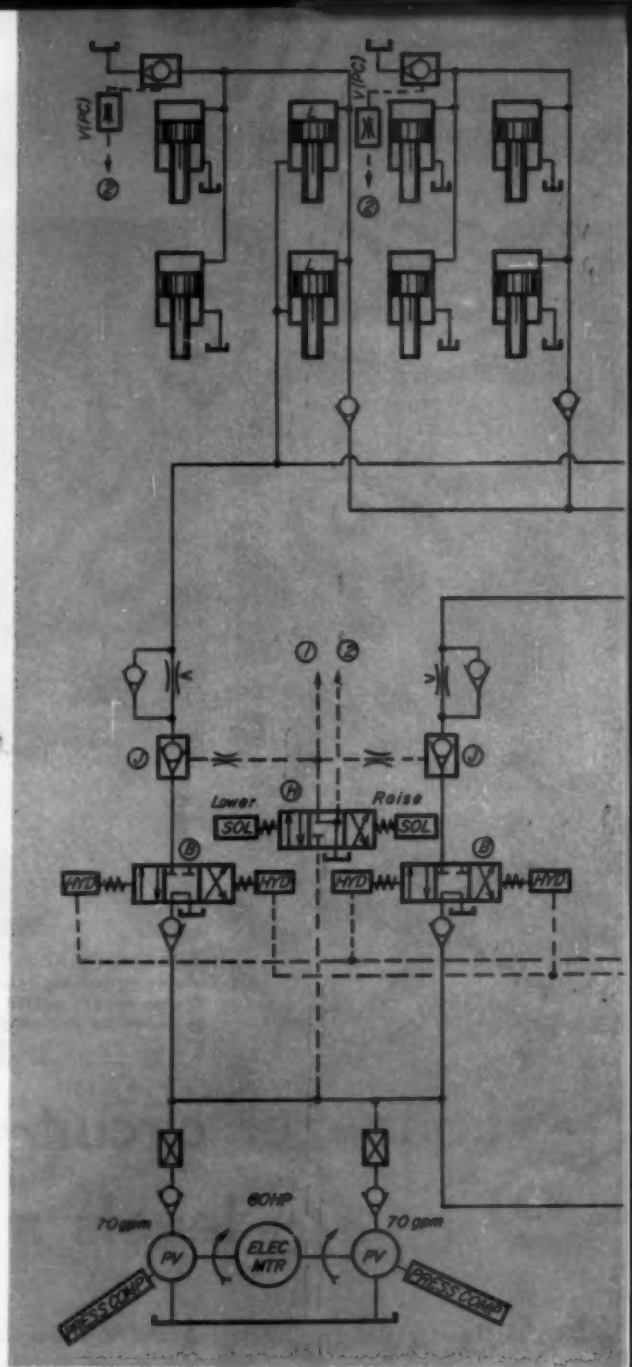




POWER PACKAGE for the plate press includes two 70-gpm pressure-compensated pumps driven by a 60-hp motor and a 40-gpm pump driven by a 15-hp motor. Filters shown at left are connected in return line and are protected by a 15-psi check valve.

VALVE PANEL shows mounting of solenoid-operated valves and pressure reducing valves. Electrical controls are in enclosure at top of panel. Gages at upper left indicate pressure at outlet of each pump and pressure on platen cylinders.

ACTUATION OF VALVE *H* applies pilot pressure to connections marked "1" for opening equalizer circuit during lowering, or to connections marked "2" for decompression and raising. Pilot-operated check valves *J* are also opened to permit lowering. Pressure set on the pressure reducing valves is either applied directly to the cylinders or multiplied by the boosters.



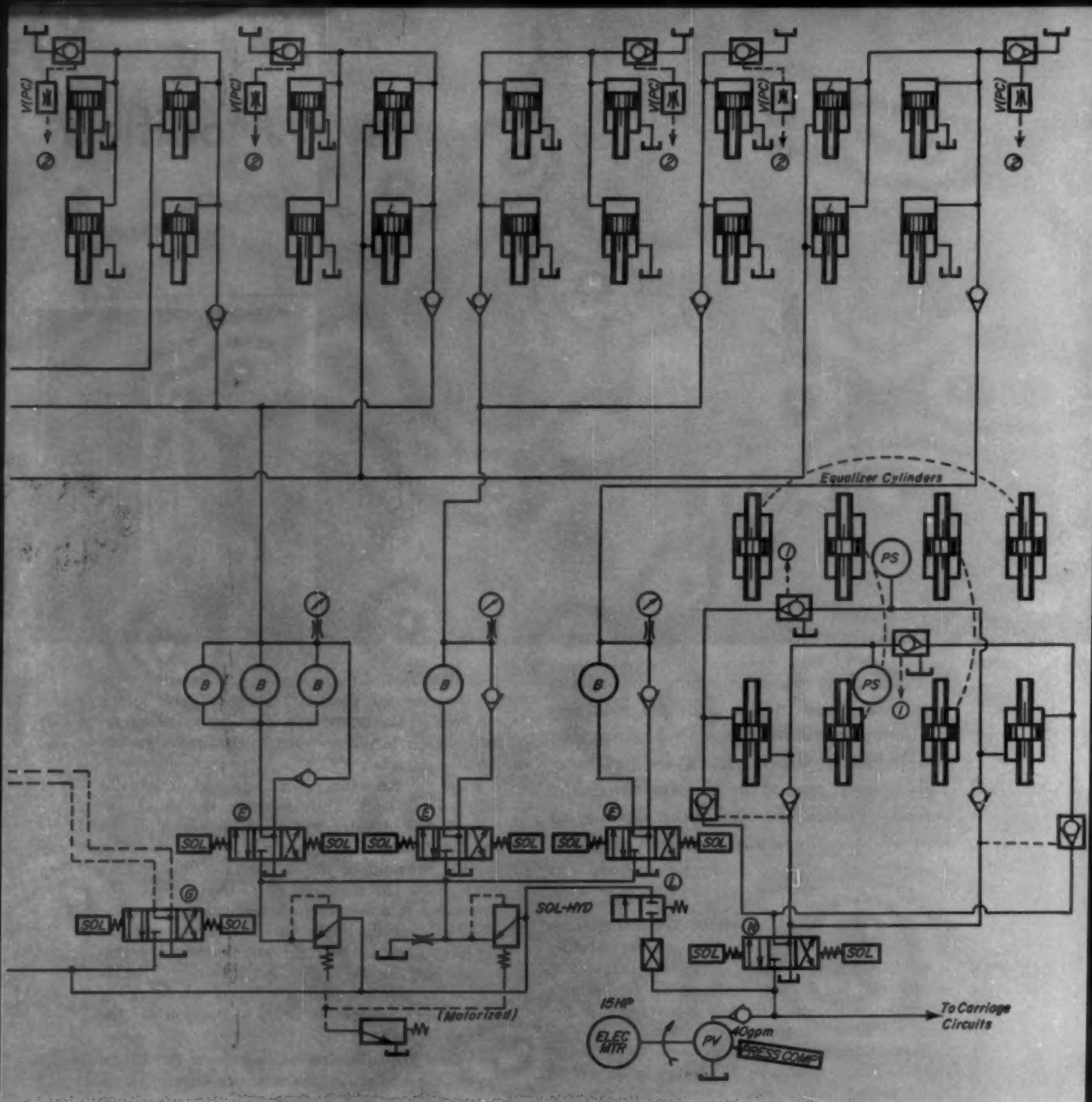
Walter A. Rankin Co., Drexel Hill, Pa. for a large, fully automatic, continuous heat treating line processing armor and commercial heat-treated steel plate. One of the important operations in this process is a pressure quench of the plate. The press was developed to keep the plate flat during this quenching operation.

Maximum force exerted by the press is 2500 tons on a maximum size plate approximately 14½ x 40 ft. in area and 3 in. thick. The equipment is structurally designed for a maximum force of 4.5 tons per sq. ft. of plate being quenched.

Work is conveyed from the heating furnaces into the press on tubular steel, driven rolls. These are mounted on a carriage which is guided into the press and raised or lowered by hydraulic cylinders. A stationary platen is located between and below the carriage rolls.

EQUALIZING SYSTEM

The eight, double rod end equalizing cylinders



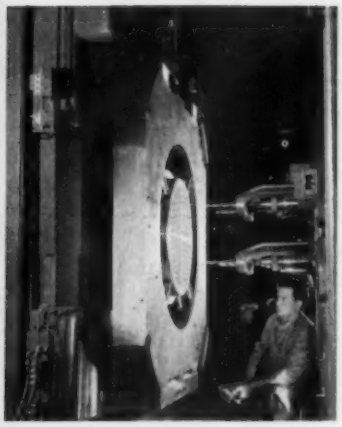
are inter-connected to maintain each edge of the platen level during the down-stroke of the platen which lowers by gravity. The hydraulic circuit diagram shows the series connection for two of the cylinders. Identical conections are indicated by the dashed lines. On the down-stroke of the platen, fluid from the lower end of each cylinder is directed to the top of the corresponding cylinder through a pilot-operated check valve which is held open.

During level descent of the platen, output from one cylinder is equivalent to the required input to the corresponding cylinder. If one corner of the platen meets an obstruction which would cause it to hang up, pressure on the top of the cylinder builds up. This pressure is also applied to the bottom of the corresponding cylinder to slow down that corner. Similar action is transmitted to all corners so that the platen is level in its descent.

After the platen is raised, pressure fluid is di-

Concluded on page 88

Modified



In building a special machine for drilling condenser end-plates, one of the most important considerations was indexing. The system had to be accurate, so that holes were evenly spaced in uniform rows. The indexing system also had to be flexible, so that various size end-plates requiring different hole patterns could be drilled.

UNCONVENTIONAL circuit ideas on this machine made some of the designers wonder whether it would work. It did, and very well. Indexing is smooth and fast because force on the ratchet lock pin is released before the pin is retracted. A no-jump circuit is also part of the system.

By modifying a standard sequence valve, Ingersoll engineers were able to design a circuit in which ratchet locking force is temporarily released, making it easy to remove the locking pin at the start of indexing.

• **Indexing Sequence**—Directional control for the INDEX cylinders is the 4-way INDEX valve. During drilling, the ADV solenoid of this valve is kept energized, so that pressure is held on the INDEX cylinders forcing the stop ratchet bar against the lock pin. When all drills have completed their forward stroke and return, the ADV solenoid is de-energized, centering the valve. As pressure drops, the pressure switch opens, energizing the OUT solenoid of the PIN valve. As the PIN valve shifts, a slug of oil is ejected from its pilot drain port. This oil is applied to the sequence valve which connects oil through the INDEX ADVANCE valve to the rod ends of the INDEX cylinders. The cylinders retract slightly to relieve force on the pin as the PIN cylinder retracts.

When the PIN cylinder has retracted, it actuates limit switch 1-LS. This energizes the INDEX ADVANCE solenoid valve and stops retraction of the INDEX cylinders. The limit switch also energizes the ADV solenoid of the INDEX valve and a time delay relay. The INDEX cylinders then extend. The time delay is necessary to permit the INDEX cylinders to bring the drills forward far enough for the locking pin to enter the next notch of the stop ratchet bar. At the end of the time delay, the IN solenoid of the PIN valve is actuated extending the PIN cylinder to lock the drills in position for the next set of holes.

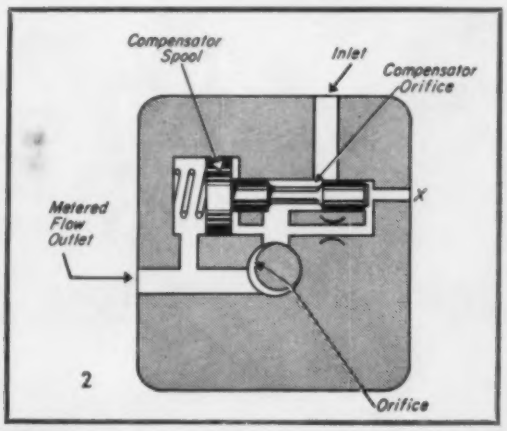
• **Valve Modification**—Using drain fluid from the PIN valve to actuate the sequence valve has been successful in retracting the INDEX cylinders at just the right time in the sequence. Because very little back pressure could be tolerated on the PIN valve for proper operation, the sequence valve was modified to require only 1/8th the normal pilot pressure. This modification included removing the small diameter projection of the valve spool against which pilot pressure is normally applied. Pressure now acts against the full spool area which is eight times the former effective area.

• **No-Jump Feature**—The pressure-compensated flow control valve connected in a meter-out circuit with the INDEX cylinders was modified to pre-

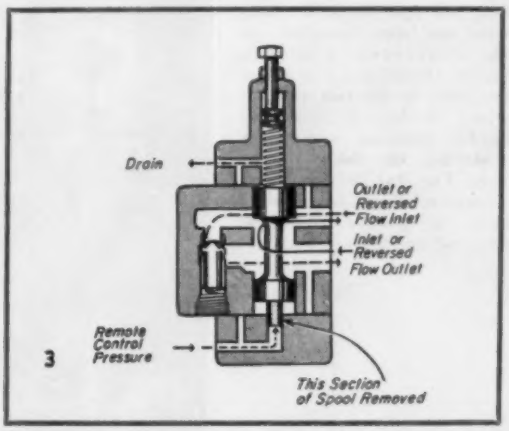
Concluded on page 90

valves smooth a big indexing job

• By Martin H. Benston, *Hydr. Eng'g. Supr., Ingersoll Milling Machine Co., Rockford, Ill.*
and A. M. Lane, *Vickers, Inc., Detroit, Mich.*



Courtesy Vickers, Inc.



Courtesy Vickers, Inc.

1

HORIZONTAL AND VERTICAL indexing are features of this drilling machine. Two 5 x 25-inch cylinders index the carriage horizontally at 5.71 in/min. Vertical index is by two 3¼ x 25-inch cylinders at 135 in/min.

2

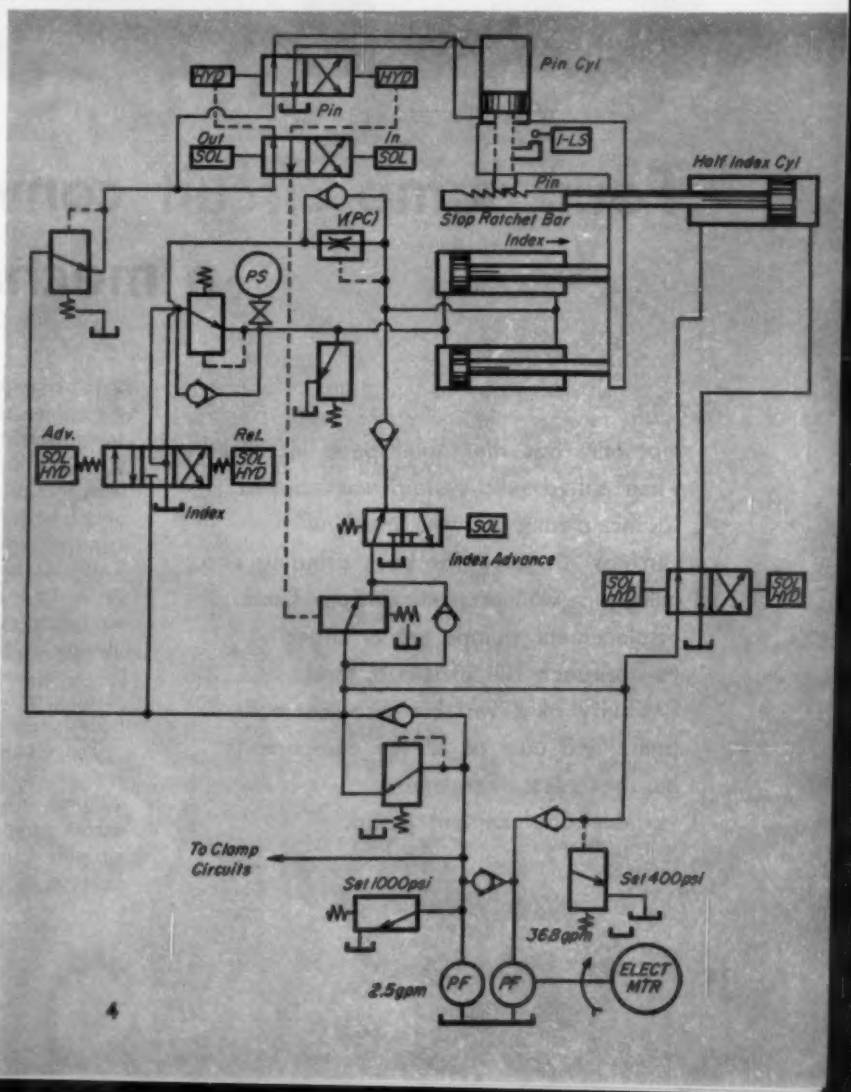
FLOW CONTROL VALVE was modified to give a no-jump system for smooth indexing. Pressure is applied at port *X* when fluid is disconnected from inlet port. This holds compensator to left against spring and closes compensator orifice. When fluid is connected to inlet, pressure at *X* is relieved.

3

SEQUENCE VALVE was modified for operation at lower pilot pressure. Shaded section of spool was removed, so that pilot pressure is applied to main spool which has eight times area of pilot piston.

4

HORIZONTAL INDEXING CIRCUIT shows connection from pilot drain of PIN valve to sequence valve, for momentary retraction of INDEX cylinders. Spring-centered INDEX valve drains both ends of cylinders during this movement.



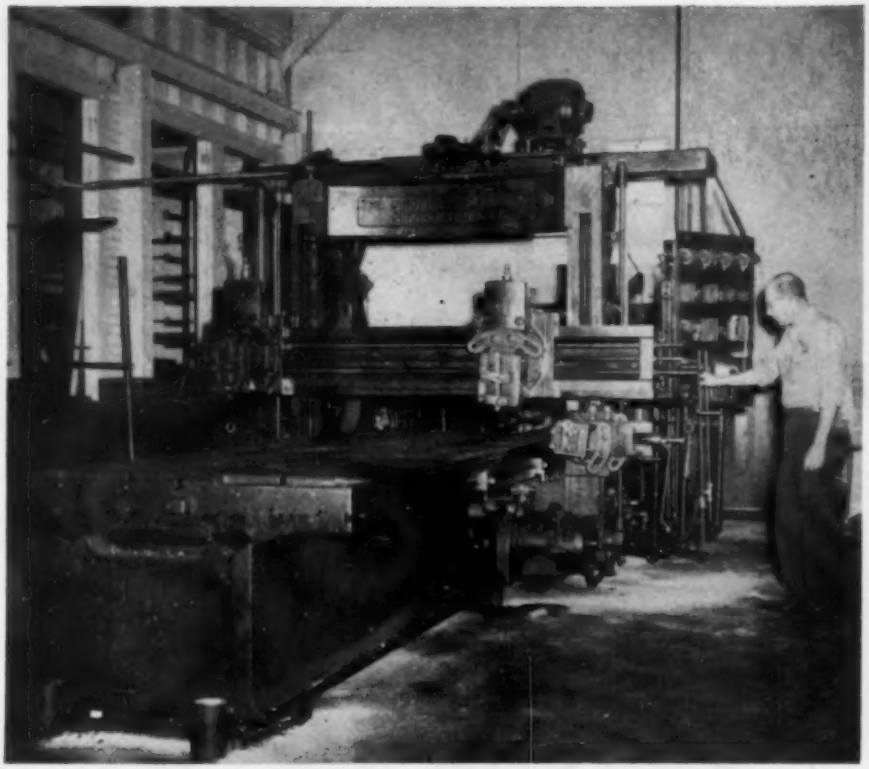


FIG. 1. TABLE SPEEDS of 0 to 135 fpm in both directions are now possible on this converted 4 x 6-ft. planer. Directional control of the table is by two manual valves. Machine is shown set up for planing, with work stroke of the table to the rear. The table drive also permits milling and grinding when the proper tooling is mounted on the cross slide.

Four pump circuit converts a mechanical planer

Not only was the table speed increased when a hydraulic system was applied to this planer, but the machine can now be used for both grinding and milling as well as planing. Four fixed displacement pumps are arranged to approach the efficiency and flexibility of a variable displacement pump and cost of all the components has been less than one variable displacement pump.

TABLE requirements of a planer are adjustable speed on the work stroke and then a fast return. In contrast, the requirements of a milling machine are much slower, adjustable, two directional feed with provision for a fast approach to the work. To obtain both of these operations on a single machine required designing a special low cost circuit. When Tufts Machine Corp. of Westboro, Mass. received the order to machine large aluminum forgings for aircraft, they had to convert several of their older planers to hydraulic operation to maintain production. Because these machines had to be used for planing, milling, and grinding, a wide range of table speeds was required.

The required table speed for grinding was 135 fpm and the approximate flow for this speed was 77 gpm. The problem was what to do with the excess pump output at the lower milling speeds. A variable displacement pump was out of the question because its cost could not be justified in the con-

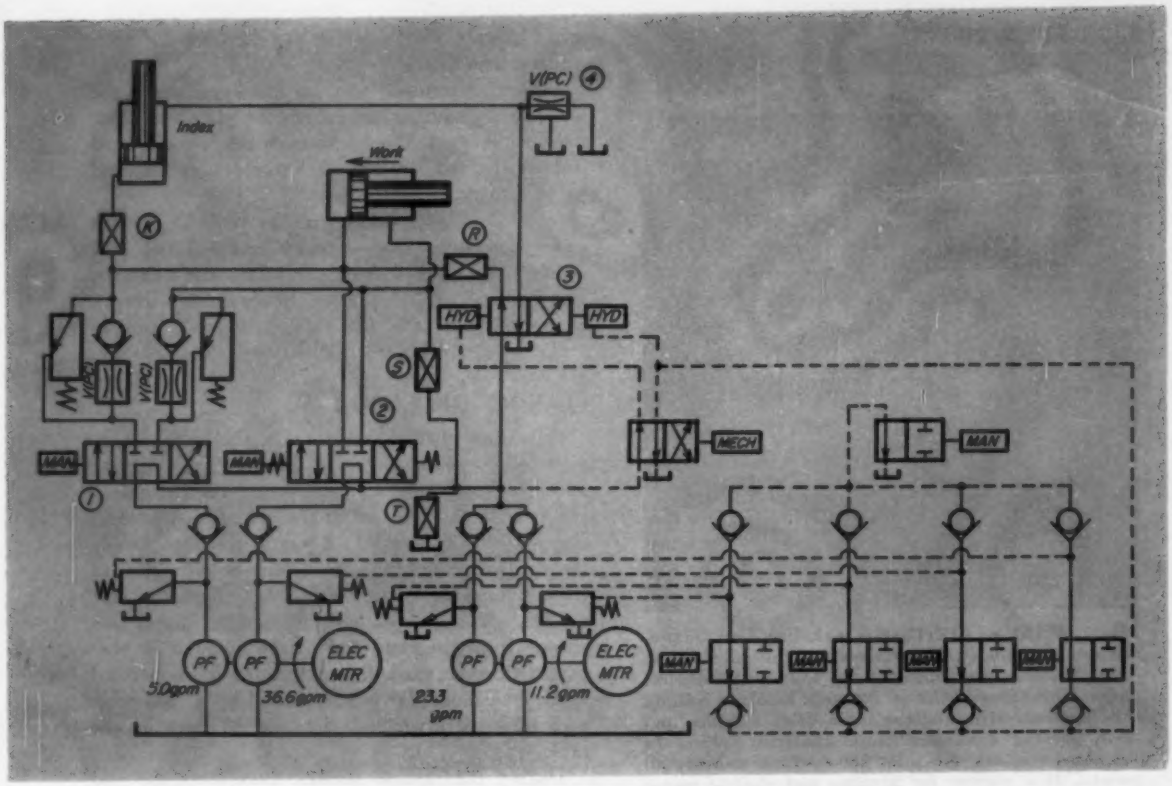


FIG. 2. PILOT-OPERATED RELIEF VALVES, individually controlled by 2-position manual valves, give pump outputs of 5 to 75 gpm in 5 to 6 gpm increments. This system, together with the flow control valves connected to meter in fluid to the cylinder, gives economical and efficient speed control with fixed displacement pumps.

• By James K. Tufts, *Treasurer, Tufts Machine Corp., Westboro, Mass.*

and J. C. Carpenter, *District Manager, Vickers, Inc., Worcester, Mass.*

version of an old machine. Accurate speed controls had to be incorporated and a meter-in circuit was desirable to prevent table jump at the start of feed. This could be encountered with a meter-out circuit because of compression of the discharge oil.

The system is completely manual and hydraulic-pilot controlled, and no electrical controls are used except for starting the pump motors. Two double pumps are driven by two separate motors to supply the table cylinder. When planing oil pressure acts on the rod end of the work cylinder as the machine table is powered through its work stroke. Although this is a disadvantage in obtaining potential force, it was necessary because of cylinder length. In fact a special extension had to be made to the factory to house the cylinder which has a 162-inch stroke.

Four pilot-operated relief valves are connected to limit pressure and to unload each pump individually. A system of four, 2-position manual valves is arranged so that any one or combination of the pumps can be unloaded during the work stroke. This permits flow outputs in approximately 5-gpm increments from 5-gpm to 75 gpm. A 6-gpm pressure compensated flow control valve bleeds off fluid from the table cylinder during the work stroke permitting infinite speed control. A fifth, 2-position manual valve connects the vent of all four relief valves to drain, unloading all pumps to stop the table.

MILLING OPERATION

In the circuit of Figure 2, valves *K*, *R*, *S*, and *T* are globe-type, shut-off valves which are opened or closed to select either planing or milling operation. With valves *K*, *R*, and *S* closed and valve *T* open, the machine is set up to operate as a miller. Operating valves 1 and 2 connects fluid from the 5 and 36.6-gpm pumps to either the head or rod end of the cylinder. The electric motor driving the 23.3

FIG. 3. MANUAL CONTROLS including four, manually operated pilot valves for venting the relief valves of each pump are shown at the top of the control panel. The second row of controls includes milling flow control valves for the table drive cylinder and their parallel connected counterbalance valves. In the third row are the pilot valve which unloads all pumps, flow control for planing and electric motor starters.

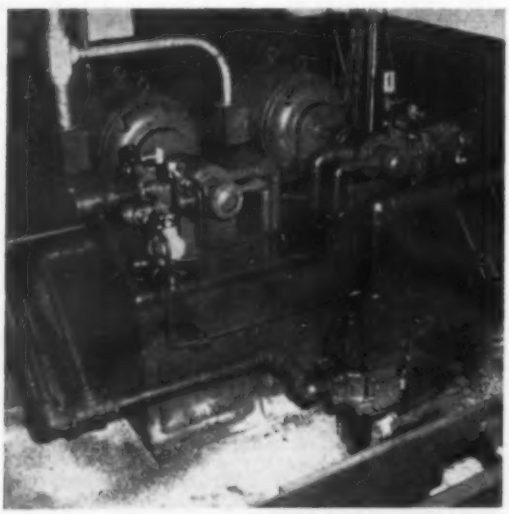


FIG. 4. POWER UNIT for the equipment mounts two double pumps and their drive motors on a 200-gallon reservoir. Pilot lines leading to the relief valves and pilot-operated 4-way are ½-inch tubing.

FIG. 5. TAIL SPARS for military jet aircraft are milled on the converted machine. These aluminum forgings produced on one of the largest presses in the world, have about 2/3 of their weight removed during machining.

and 11.2-gpm pumps is not operated during milling and grinding.

Valve 2 is actuated only for fast approach to the work during milling and is released when the cutter reaches the work. Discharge from the cylinder head end is directed through directional valve 2, and valve *T* to drain.

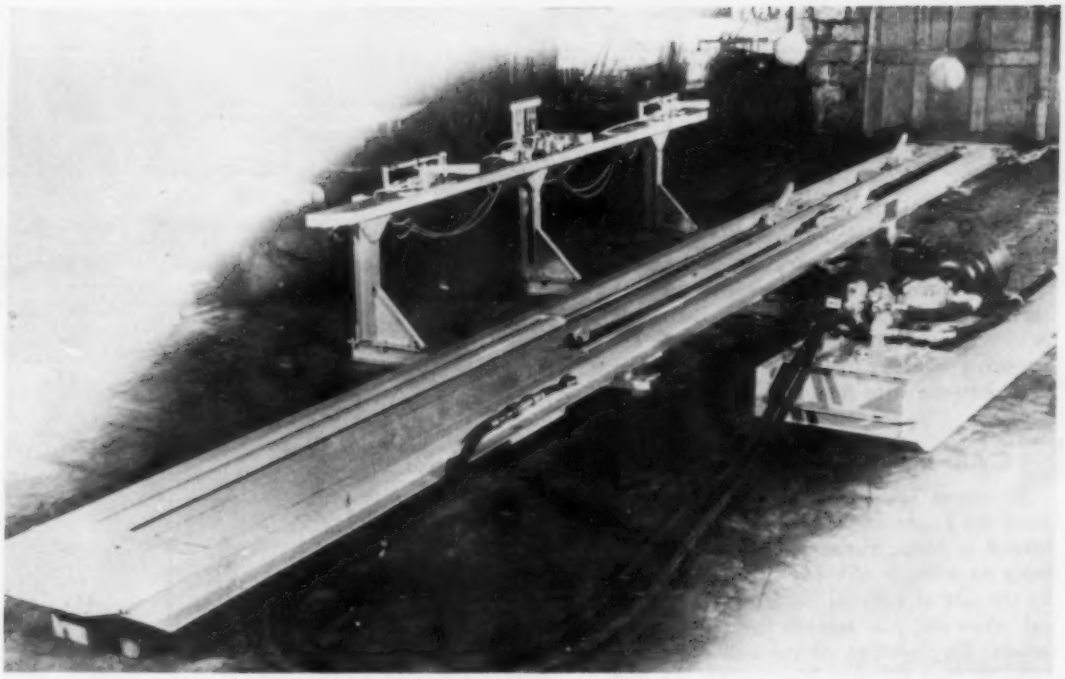
Valve 1 is actuated to put the table in feed in either direction. Two pressure compensated flow controls are used to meter oil into the cylinder. The exhaust oil from the cylinder passes over a counterbalance valve and through valve 1 back to tank.

PLANING OPERATION

Operation of the machine as a planer is accomplished by opening valves *K*, *S*, and *R* and closing valve *T*. The 5-gpm and 36.6-gpm pumps can supply fluid to the rod end of the cylinder as in milling, and the 23.3 and 11.2 pumps can also supply the cylinder through valve *S*. Any combination of these pumps can supply the system depending on the operation of the 2-position manual valves. Discharge from the head end of the cylinder is connected through valve *R* and through pilot-operated valve 3 to tank. Valve 3 is shifted by a cam-operated pilot valve which is actuated by dogs on the table.

During the reverse stroke, fluid from the rod end of the cylinder flows through valves *S*, 3, and *R* back to the head end. This forms a differential circuit to increase the return speed.

The pumps which were unloaded through the mechanical valve during the work stroke, deliver to the system during the return stroke. ▼▼▼



LOADING SYSTEM PROPELS cars with two single-acting hydraulic cylinders. Height of coal in the cars is sensed by a ball hung from a length of roller chain. Fingers detect car position and actuate valves to coordinate the sequence.

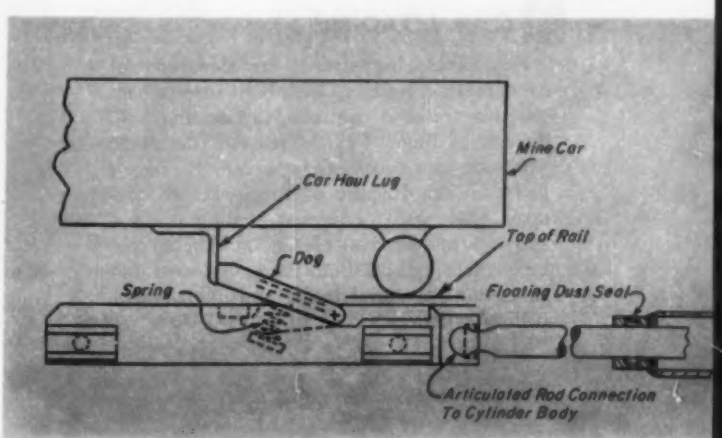
Piloted relief valves keep power requirements low

• By W. R. Stamler, *President, The W. R. Stamler Corp., Paris, Ky.*

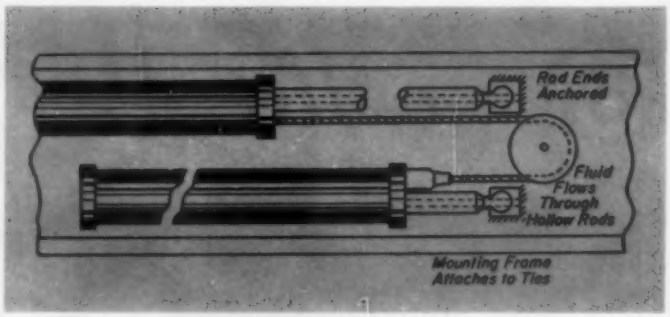
MINING cars must be moved along gradually while being filled from a hopper to ensure even filling; and when one car is filled, the next one must be brought into position. Between filling cars, the flow of material must be stopped or diverted in some way.

1 CAR PROPULSION

Two, single-acting hydraulic cylinders, mounted between the track rails move the mine car. Cylinder sizes vary, depending on application, to give forces from 8000 to 20,000 lbs. over stroke lengths of 18 and 24 ft. at speeds of 24, 27, 37 or 40 fpm. Ratcheting dogs, driven by the cylinders, bear against car-haul lugs attached to the car floor. When



a cylinder completes its forward stroke, valving automatically applies pressure to extend the other cylinder. Spring-loaded pushing dogs are forced down as they pass beneath car haul lugs during retraction. Retraction is by a sheave and length of wire rope. The extending cylinder pulls the other cylinder back with the wire rope.



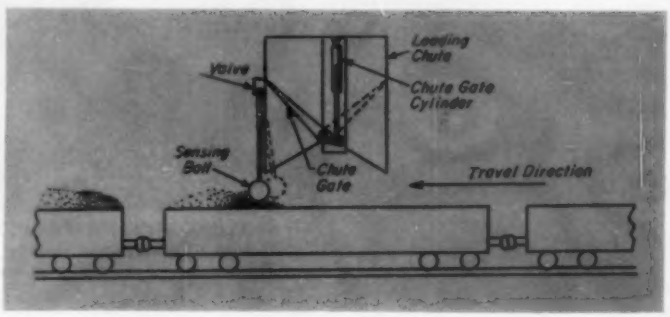
2 CAR POSITION

Movement is controlled by devices which sense the height of the coal in the car being loaded. A 10-in. diameter, hollow, metal ball hung on a length of roller chain is displaced by the pile of material being loaded into the car when the pile reaches the required fill height. Displacement of the ball operates a valve to start the propelling system. As soon as the car has moved to a position where the piled coal does not displace the ball, the valve stops the propelling system and filling continues at that point until correct material height is reached.

This process is repeated until the entire car is uniformly loaded. This is sensed, and a gate in the loading chute or hopper is pivoted by a hydraulic cylinder to deflect the flow of material into the next car.

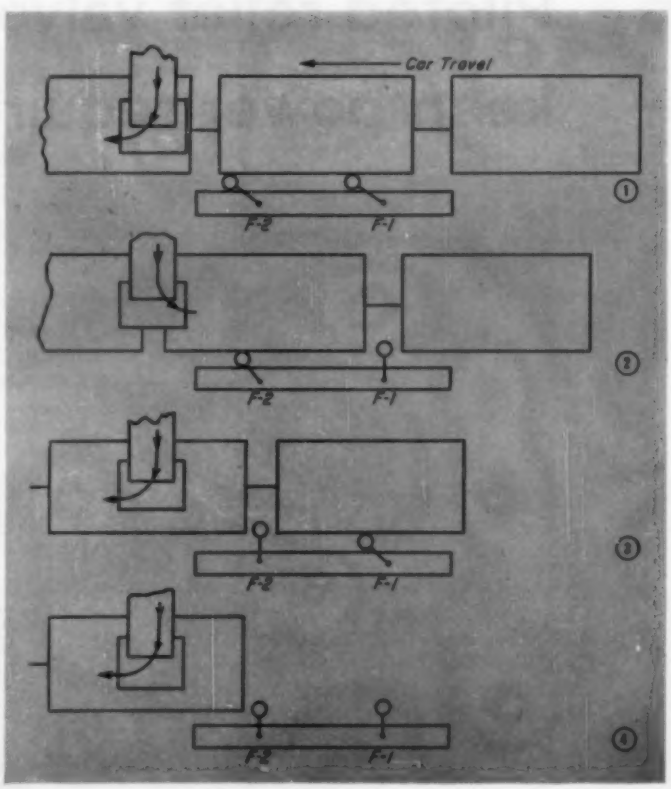
The sensing ball is hung on roller chain to provide a rigid connection between the ball and pilot valve when the ball is moved at an angle of 45 degrees to the centerline of the track. Force applied at other angles causes the chain links to pivot. This protects the ball and valve to which it is linked. The 10-in. diameter sphere floats on the surface of the coal pile and shows no tendency to be trapped or submerged in the pile.

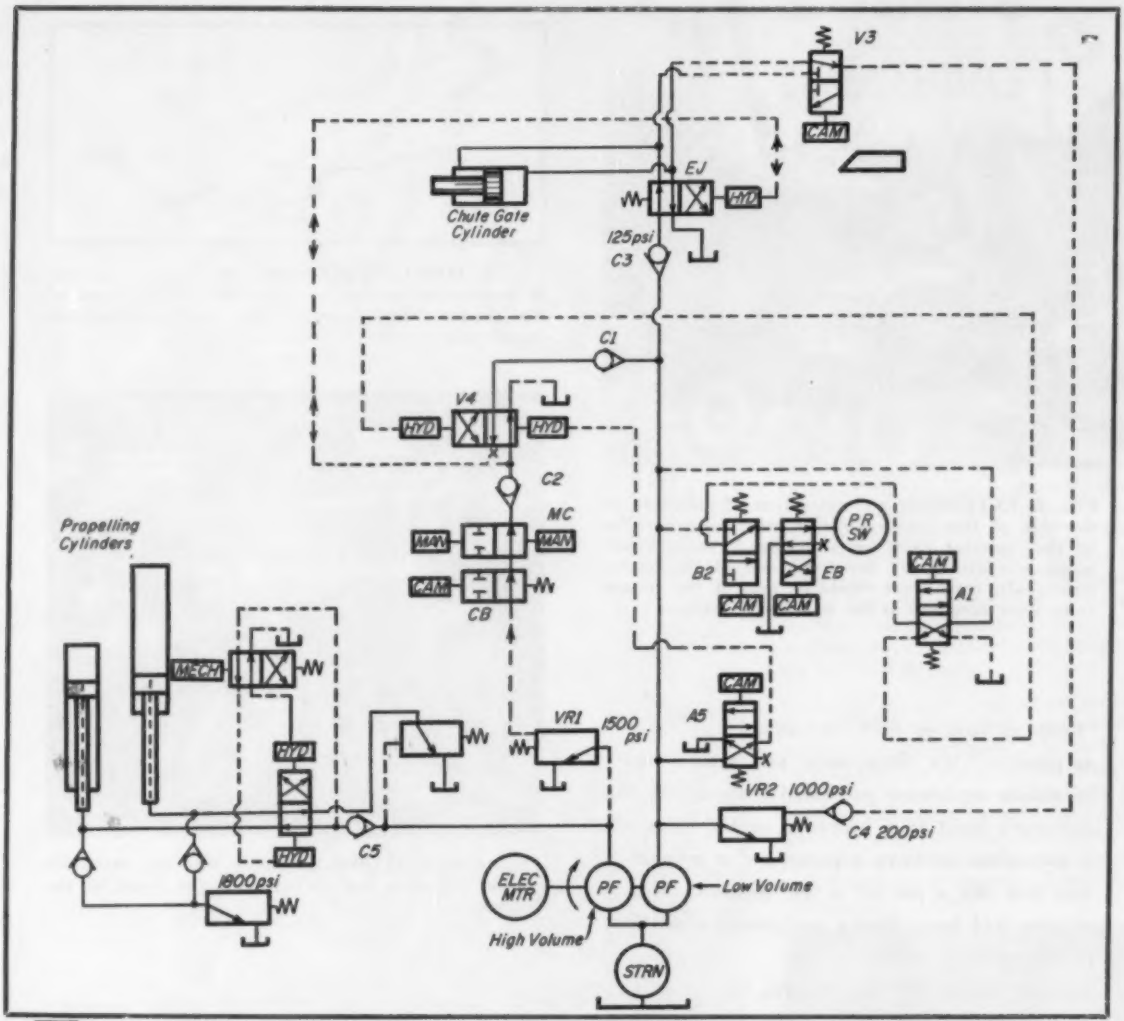
An emergency sensing ball, just like the other, but 6-in. higher, works its valve if the main control fails.



3 CAR LOADING

Fingers bearing against car sides control the automatic loading. With both fingers held (1), car travel is controlled by sensing ball. Release of finger F1 (2) reverses the chute gate, and cars travel on regardless of sensing ball position. Release of finger F2 (3) returns chute gate to normal feeding position and returns control of car motion to the height sensing ball. Both fingers released (4) shuts down material feeder and unloads propelling cylinders.





4 HYDRAULIC CIRCUIT

When both sensing fingers are held by the car sides, and neither the primary nor emergency ball is deflected, fluid from the high-volume section of the pump is dumped to tank through vented relief valve *VR*1. Pressure of approximately 25 psi is maintained in the line to the propelling cylinders as long as the vent is open.

To start propelling action vent of *VR*1 may be blocked by *CB* which is actuated by the primary control ball, by *MC* which is a manual control to permit moving empty cars or by *V*4 which is controlled by pilot valves *A*1 and *A*5. *A*1 is actuated by control lever *F*1. *A*5 *and B*2 are operated by control lever *F*2.

The 1800 psi relief valve in the propelling circuit prevents damage to the system if load on the propelling cylinder becomes excessive, as it might if a locomotive backed into the string of cars. Check valves between the cylinders and the relief valve prevent flow from one cylinder from passing to the other cylinder during such an event.

The counterbalance valve in this circuit maintains back-pressure on the cylinder being mechanically retracted and prevents its being retracted any faster than the other cylinder is advancing when the system is installed on an incline. Check valve *C*5 in the line from the pump to the main four-way valve prevents backward drift of the car and propelling cylinder due to gravity when pressure is not applied.

Action of *EJ*, *V*3 and *VR*2 maintains pressure in the pilot circuit at 200 psi or less except when chute gate motion is required. Shift of *EJ* to operate the chute gate cylinder applies pressure to *C*4 through *V*3. Low volume pump pressure can then build up to *VR*2 setting. Shift of *V*3 at midpoint of gate travel again unloads the vent line. Gravity and weight of material being fed complete cylinder stroke.

Valve *EB* is an emergency shutdown actuated by the emergency ball. Excessive coal height actuates *EB* to block pressure from the pressure switch. Pressure switch contacts then open and stop coal feed elevator, or conveyor. ▼▼▼

FIG. 1. EXTENSION and retraction of cylinders on the side of this crawler tractor must be controlled by the operator from his seat. Since the hydraulic pump was driven off the front end of the engine crankshaft, fluid lines would be long if the control valve were mounted at the operator's position.

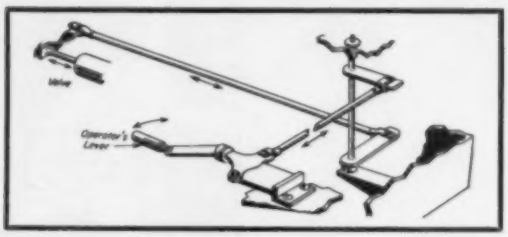


FIG. 2. THIS LINKAGE permits the tractor operator to actuate the control valve mounted at the front of the tractor. Fluid lines are thus kept to minimum length and number.

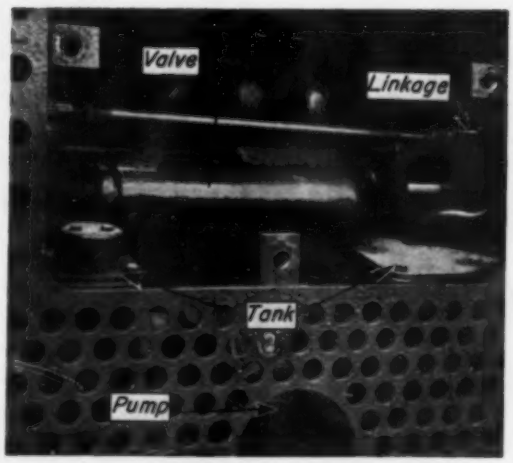


FIG. 3. ALL HYDRAULIC units with the exception of the cylinders are packaged at the front of the tractor.

"Keep all lines as short and straight as possible!" It's often easier said than done. In mobile equipment particularly, connecting the operator's hand to a hydraulic control valve which is someplace between a pump and a cylinder may look like a job for a few thousand feet of pipe and hose. Here's one practical solution to this problem arrived at by Superior Equipment Co., Bucyrus, O.

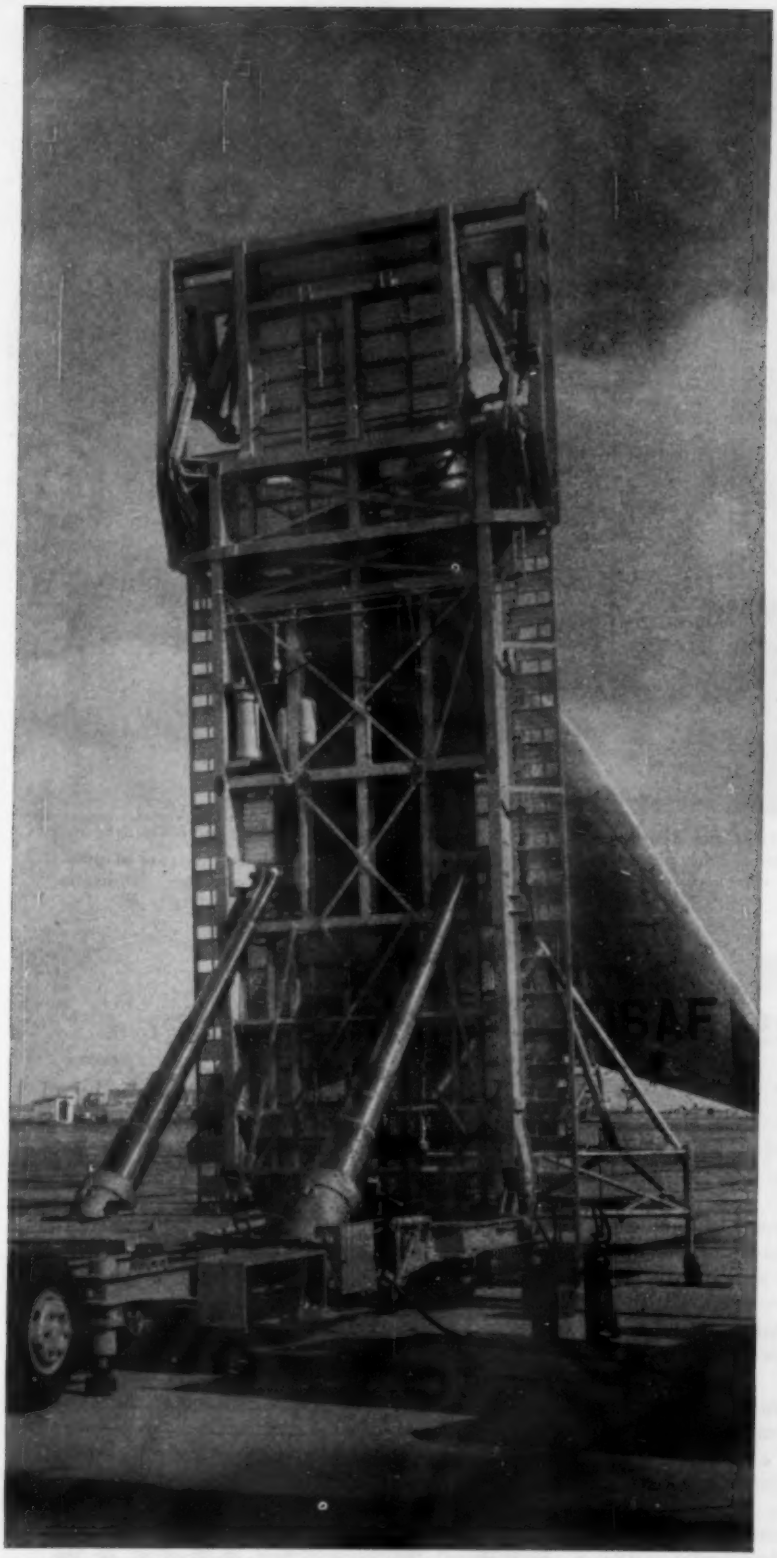
Valve operating linkage reduces fluid line length

OPERATOR, hydraulic pump and cylinders are all far apart on the crawler tractor shown in Figure 1. The pump, driven off the front end of the engine crankshaft, is directly behind the perforated plate guard on the front of the tractor. Obviously, if the control valve is put right next to the operator, a lot of piping and hose will be necessary to connect valve, pump, and cylinders.

How would you keep fluid line lengths short and direct?

● **The Solution**—By using a linkage, Figure 2, between operator's position and the front of the tractor, it was possible to use a hydraulic package consisting of pump, tank, and all necessary valves at the front of the tractor, Figure 3. All fluid connections are made directly to tank except pressure and return hoses from the control valve to the two cylinders at the side of the tractor.

● **Function**—Hydraulics are used in this application to extend and to retract a large weight on the side of the tractor in order to counterbalance a crane and its load on the opposite side. ▼▼▼

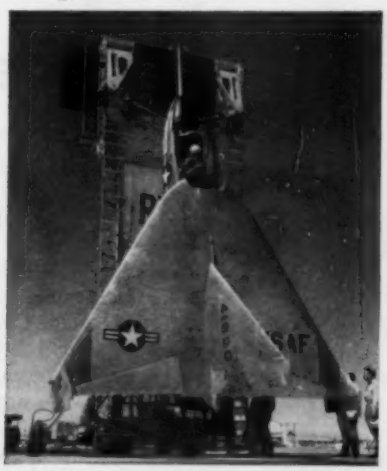


ALL CYLINDER COMPONENTS are structurally designed to withstand a shock impact load equivalent to a 3G landing of the aircraft. Stroke of the bed raising cylinders is 152½ inches; trunnion to pin eye centers, 179 inches extended–26½ inches closed. Cylinder inside diameters range from 14 inches in the mains to 5¾ inches in the smallest sleeves.

Six-sleeve telescopics deliver 77-ton in-line push

THIS 9000 lb. vertical "landing field" and the aircraft riding piggy back are hydraulically positioned in just 3½ minutes by the two large COMMERCIAL six-stage telescopic cylinders. They stretch out over 10½ feet in playing a key role in the successful takeoff and landing of the U. S. Air Force Ryan X-13 Vertijet. In returning from vertical to horizontal position a double acting control in these cylinders enables the bed to be pulled over the center of gravity. Special features built into the first and sixth stages set up this unique operation. Once past the center of gravity, the cylinders return to their closed position by the weight of the bed and aircraft.

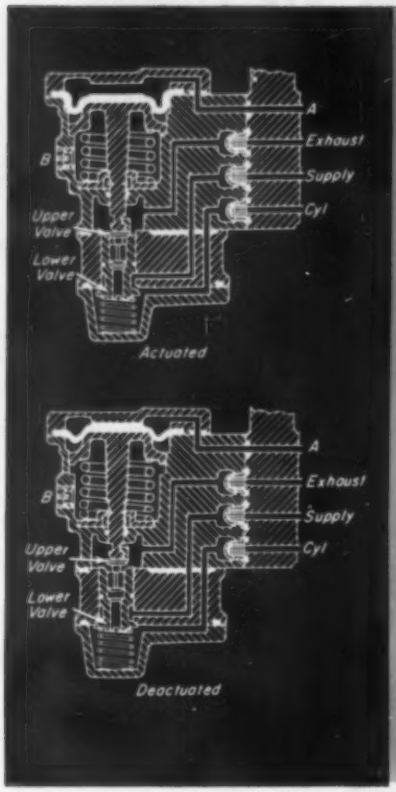
Here was another application problem that COMMERCIAL'S versatility in fluid power engineering helped to solve. If you have a fluid power problem involving pumps, valves, motors or cylinders, perhaps we can come up with the solution quickly and economically. Address inquiries to The Commercial Shearing and Stamping Company, Dept. A-9. Youngstown 1, Ohio.



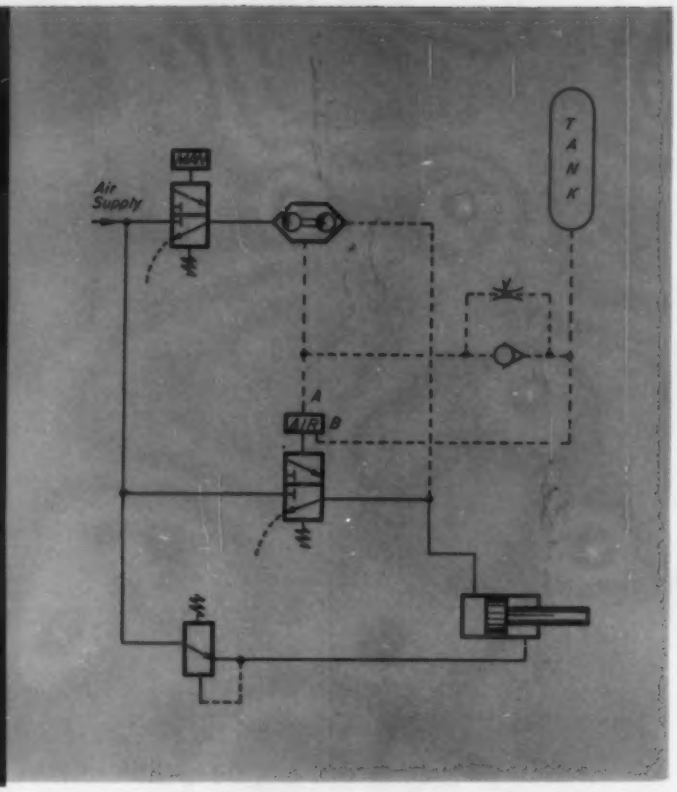
CABLE ARM operating and cable tensioning cylinders, trailer outrigger jacks and two sizes of pumps to generate the fluid power for the hydraulic system were also furnished by COMMERCIAL.

COMMERCIAL
shearing and stamping

CIRCLE 33 ON READER SERVICE CARD



AIR-OPERATED DIRECTIONAL VALVE has double-acting operator. Upper valve is operated by piston. Lower valve is opened by upper valve, closed by spring.



Courtesy Westinghouse Air Brake Company.

TIMING IN THIS CIRCUIT depends on rate of pressure build-up in tank and valve operator. Timing is regulated by flow control valve.

Air pressure times cylinder

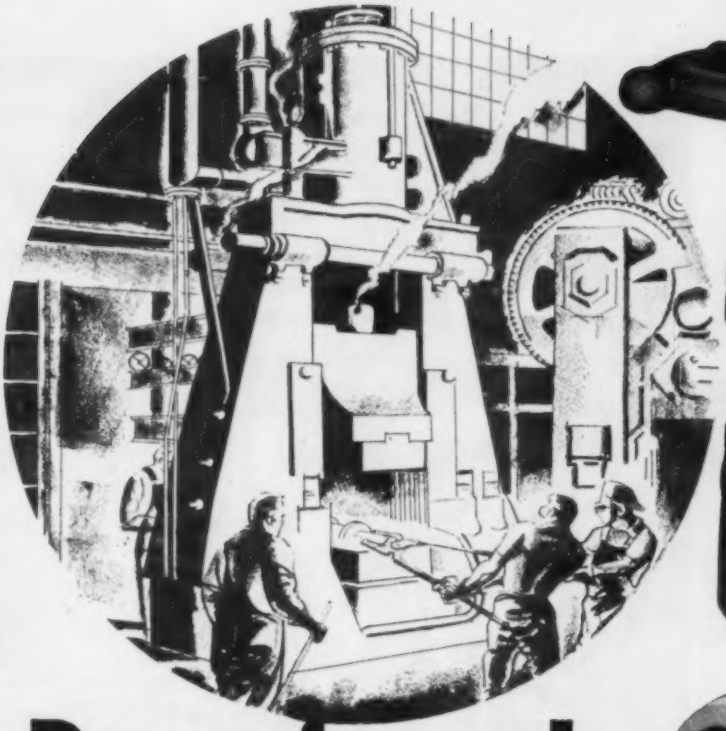
A SIMPLE way of timing dwell of an air cylinder is by metering pilot air to the piston operator of the control valve.

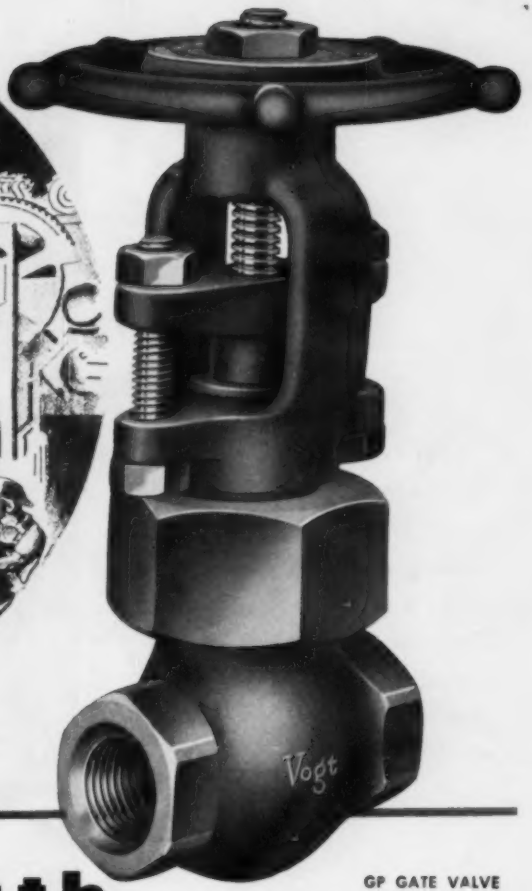
On a foundry core pasting machine, an air-actuated machine was developed to raise and lower a paste pan, controlling the amount of paste used in the assembly of a core from several parts. High speed operation was essential and the same amount of paste had to be applied to each core assembly.

A 3-way, pedal type valve actuates the circuit by connecting air through the double check valve to the diaphragm operator of a second 3-way valve. This valve extends the cylinder, raising the paste pan. When the pedal valve is released, the 3-way valve locks in by air pressure tapped off its outlet line, through the double check valve to the valve operator.

Air is also directed through the flow control needle valve to the timing tank and to port *B* on the valve operator. After a timed period, set on the needle valve, pressure builds up on the underside of the valve piston, forcing it to its spring-loaded position. The head end of the cylinder is then exhausted, and the cylinder is retracted by reduced pressure which is always applied to its rod end. The timer tank and valve operator are also exhausted for the next operation.

• **Directional Valve**—The 3-way directional valve has a spring-loaded, double acting diaphragm operator. Applying air pressure at port *A* closes the upper valve between the exhaust and the cylinder port, and opens the lower valve between the supply and the cylinder ports. When pressure at Port *B* reaches a value so that the force acting on the underside of the diaphragm plus the spring force just exceed the force acting on the top of the diaphragm, the valves move to their spring-loaded positions. This connects the cylinder port to exhaust, and blocks the supply port. ▼▼▼





Drop forged for Strength and Safety

GP GATE VALVE
SERIES S-9530

Drop forging techniques, resulting from more than a half century of pioneering and development by Vogt in the production of forged steel valves, impart matchless strength and safety to the new line of Vogt GP Valves. Made from killed, clean, fine grained open hearth steel billets, forging and treatment operations result in additional grain refinement and increased toughness.

GP Valves are setting new standards of performance in petroleum refineries, chemical plants, power plants, and related industries. Available in a complete range of sizes from 1/4" to 2" and rated 800 pounds at 850°F. and 2000 pounds at 100°F.

Advt. No. 4 in a series describing the features of Vogt GP Valves.

Write For Your FREE COPY of Supplement No. 1 to Catalog F-9. **Dept. 24A-FAH**

HENRY VOGT MACHINE CO.
P. O. Box 1918—Louisville 1, Ky.

SALES OFFICES: New York, Chicago, Cleveland, Dallas, Philadelphia, St. Louis, Charleston, W. Va., Cincinnati,

Vogt

GENERAL GP PURPOSE

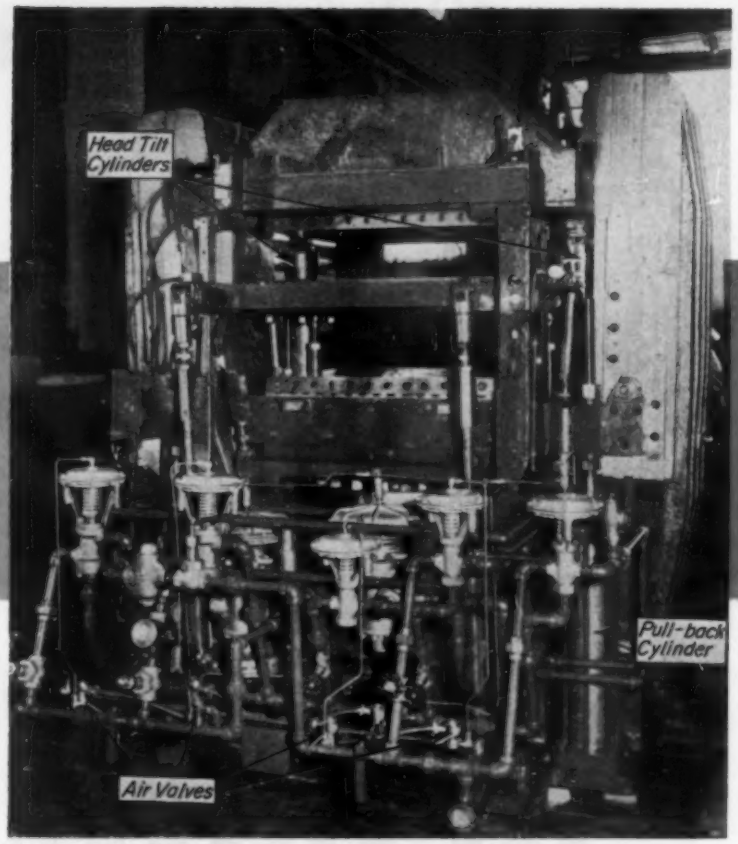
Vogt FOR BETTER VALVES

DROP FORGED STEEL

VALVES

CIRCLE 140 ON READER SERVICE CARD

Poppet type, diaphragm-operated valves on this rubber molding press require a 30-psi air control system. The solenoid air valves are actuated by timers and limit switches which interlock and control the automatic cycle.



VALVE ARRANGEMENT at rear of press shows diaphragm-operated valves and solenoid air valves which control them. Head is raised by two cylinders at front of press. Four pull-back cylinders are at corners.

Air circuit controls water-operated press

• By Robert Guggenheim, *Hale & Kullgren, Inc., Akron, Ohio*

SEQUENCING operation of this rubber molding press was a design problem in electrical controls and air valving. The action of the press, which has a tilting head, tilting center deck, and side arms which lock the head in the *down* position, facilitates removal of the work without removing the molds. This design has the advantages of hydraulic operation and gives good access to all parts of the mold, as well as a short ram stroke which minimizes overall cycle time.

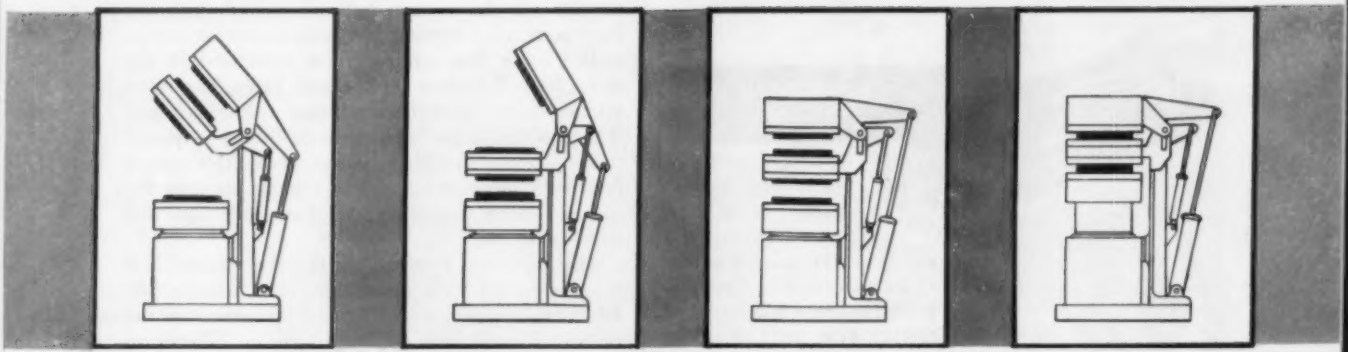
PRESS OPERATION

With the head and center deck tilted up and mechanically locked, the operator fills the lower mold. By releasing the mechanical lock and actuating a pushbutton, he lowers the center deck and fills the upper mold. He then actuates a pushbutton and releases a mechanical lock to lower the head to the horizontal position. At this time the main ram rises to start the molding cycle. As the ram rises, it cam actuates the side arms to lock the head in place. The ram continues its upward travel applying full force on the molds. Bumping and cure time is controlled by timers. The ram is then lowered by pull-back cylinders. As the ram nears the bottom of its stroke, the side arms are forced out to unlock the head which tilts up for unloading the work.

To separate the upper molds, two breaker cylinders act down on the center deck as the main ram

Continued on page 86

PRESS POSITIONS



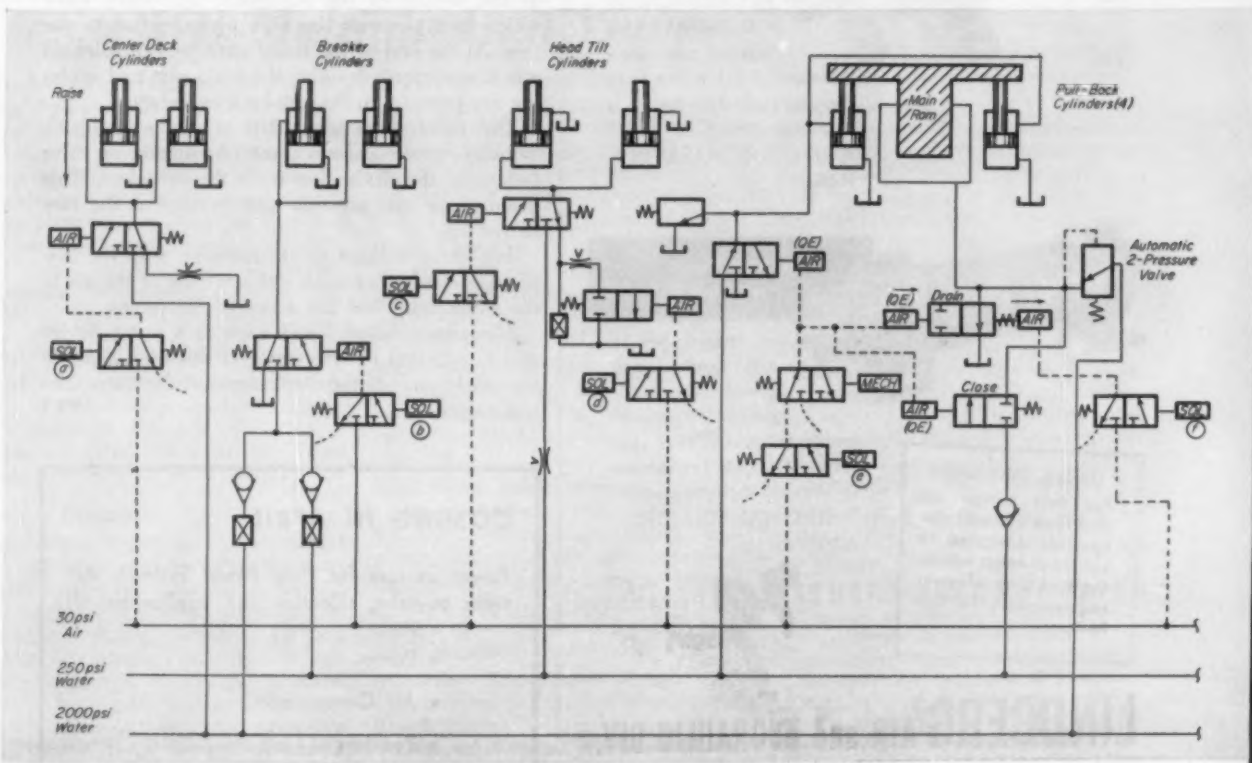
HEAD and center deck tilted for loading lower mold.

CENTER deck lowered for loading upper mold.

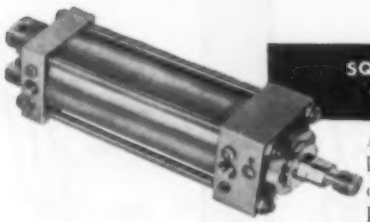
HEAD lowered for molding cycle.

RAM up for pressing.

QUICK EXHAUST (QE) on valve operators indicates a separate valve which permits exhausting air from the diaphragm directly to atmosphere without going back through the controlling solenoid valve. This is for fast action on the larger valves because only the spring forces air out of the diaphragm operator.

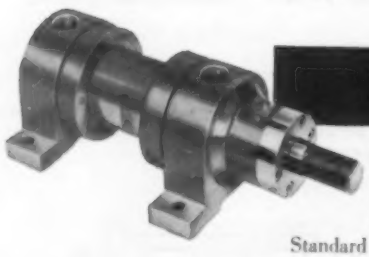


for that
BIG PUSH
LINDBERG HAS THE RIGHT CYLINDER



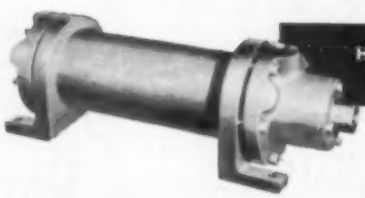
SQUAREHEAD "5" LINE

A feature packed line with the "quick change" feature • Rated 250 psi for air, up to 1000 psi hydraulic • 7 bore sizes thru 6" • Standardized mounting dimensions.
WRITE FOR BULLETIN S-101



2000 PSI "H" LINE

An extra heavy duty hydraulic cylinder • Available with or without cushions • Standard or 2:1 rods • Bore sizes through 8 inches in 5 mounting styles.
WRITE FOR BULLETIN H-101



HEAVY DUTY "A" LINE

A rugged non-tie rod cylinder for air pressures up to 150 psi and low pressure hydraulic service. Bore sizes through 12 inches • Cushions optional • 5 mounting styles.
WRITE FOR BULLETIN A-101

OTHER CYLINDERS
For fast action on mill type cylinders or specials designed to suit your exact needs, send outline of your requirements to our factory.

LINDBERG AIR and HYDRAULIC DIV.
TEER, WICKWIRE & CO.
1802 WILDWOOD AVE., JACKSON, MICHIGAN
CIRCLE 124 ON READER SERVICE CARD

AIR CIRCUIT CONTROLS WATER-OPERATED PRESS

moves down. These can be operated either from the low or high pressure system depending on the part being molded.

CIRCUIT OPERATION

The two CENTER DECK cylinders connected in parallel tilt the center deck when high pressure fluid is supplied to their rod ends. Lowering is controlled by a flow control valve connected in the drain from the 3-way air-operated valve. The HEAD TILT cylinders raise the head when solenoids *c* and *d* are energized and high pressure fluid is supplied to the head ends of the cylinders. If electrical power fails with the ram up, it will remain up until the shut-off valve bypassing the 2-way air operated valve is opened.

The main ram is connected to low pressure fluid when solenoid *e* is energized. This actuates the DRAIN and CLOSE valves and also opens the rod ends of the pull-back cylinders to drain. The DRAIN valve controlling the ram drain connection has two diaphragm operators. To stop the press at an intermediate position, solenoid *e* is de-energized and solenoid *f* is energized to direct air to the second diaphragm of the DRAIN valve. This holds the valve closed.

When the ram meets the work, pressure builds up to the setting of the automatic 2-pressure valve which then connects the high pressure line to the ram. At the end of the timed cure period, solenoid *e* is de-energized, draining the main ram and applying low pressure to the pull-back cylinders.

The relief valve connected with the pull-back cylinders protects against any obstruction or valve failure in the drain line from the cylinders. This could cause over-pressure and damage as the ram moves up.

The quick exhaust valves installed with the diaphragm operators permit quick release of the air in the diaphragms and fast action of the valves.

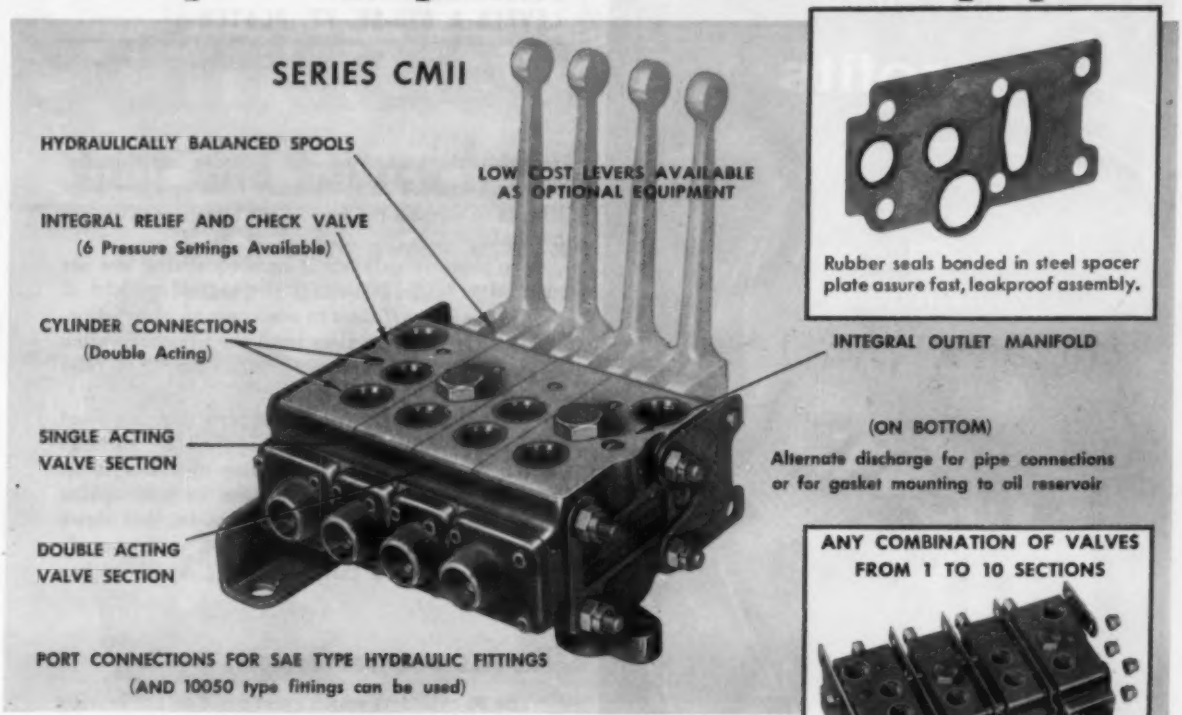
The cam-operated 3-way valve is a safety device and is actuated by overtravel of the ram. Shifting the valve exhausts the diaphragms of the water control valves. ▼▼▼

COMING IN APRIL

Power Sources for Fluid Power Systems. Articles covering selection and application of:

- Pumps
- Air Compressors
- Boosters
- Accumulators

For Improved Operation of Mobile Equipment


SERIES CMII
HYDRAULICALLY BALANCED SPOOLS
LOW COST LEVERS AVAILABLE AS OPTIONAL EQUIPMENT
INTEGRAL RELIEF AND CHECK VALVE
(6 Pressure Settings Available)
CYLINDER CONNECTIONS
(Double Acting)
INTEGRAL OUTLET MANIFOLD
(ON BOTTOM)
Alternate discharge for pipe connections or for gasket mounting to oil reservoir
SINGLE ACTING VALVE SECTION
DOUBLE ACTING VALVE SECTION
PORT CONNECTIONS FOR SAE TYPE HYDRAULIC FITTINGS
(AND 10050 type fittings can be used)
Rubber seals bonded in steel spacer plate assure fast, leakproof assembly.
ANY COMBINATION OF VALVES FROM 1 TO 10 SECTIONS
Easy Sectional Assembly

Improved Vickers CM11 Multiple Unit Valves

Improved control, greater convenience and economy have been provided by this new design of Vickers Series CM11 Multiple Unit Valves. They are widely used on such applications as: material handling equipment, farm tractors, construction and mining machinery, bucket loaders, and many other types of mobile equipment where accurate control of hydraulic power is required.

Simultaneous Functions

Valves may be operated individually or simultaneously. Saves operator's time on the job. Full pump delivery is available at any one valve when operated singly.

Precise Control

Improved metering characteristics and Vickers exclusive porting arrangement make possible a smooth and selective control . . . greater precision in nudging, crowding, inching and positioning. Valve spools are spring centered to neutral position and hydraulically balanced to prevent kicking-out due to excessive back pressure or surges. A check valve in the inlet prevents pressure surges at the cylinder from acting destructively on the pump.

Overload Protection

Tamper-proof integral relief valve provides excellent overload protection and low override characteristics. Relief valve is preset at factory to any one of 6 cracking pressures from 500 to 1750 psi (250 psi increments).

High Capacity

Maximum capacity is 12 gpm with three or less valve sections, or 9 gpm with over 3 valve sections. Maximum working pressure is 2000 psi.

Sectional Assembly

A high degree of control flexibility from minimum inventory is assured users requiring a variety of valve assemblies.

Seal Plate Subassembly

Steel spacer plate with rubber seals bonded in place allows rapid, leakproof assembly of valve sections. Plate subassembly permits instant, positive joining of sections with no danger of overstressed through bolts and cramped valve spools.

Minimum Space and Weight

Simplified design and construction characterize CM11 valve assemblies. Valve end sections combine in one casting the inlet or outlet manifold together with any operating valve section . . . saving space and weight.

Easy Mounting

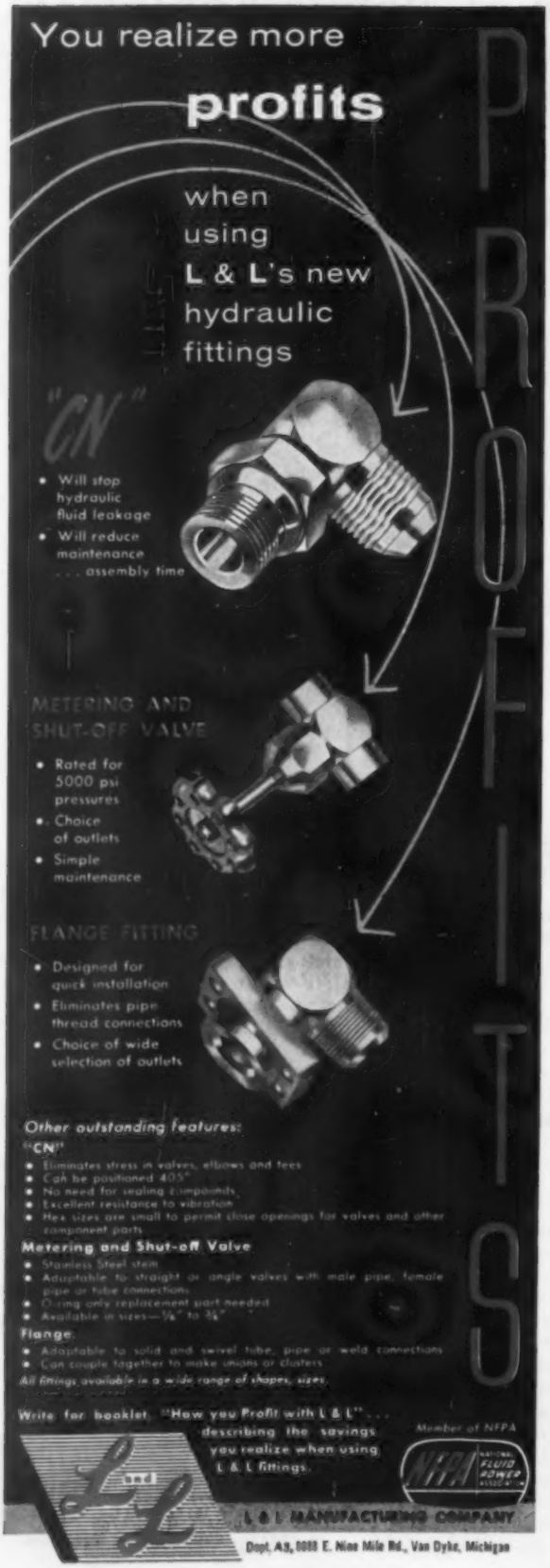
Mounting is a simple three-point installation. Cylinder connections are ¾-16 UNF-2B thread (SAE type) . . . inlet and discharge ports are ¾-14 UNF-2B thread (SAE type). Alternate discharge connections in bottom of end sections provides for gasket mounting to oil reservoir or to ½" threaded pipe.

Interchangeability

Interchangeable valve sections assemble for both original and conversion equipment with minimum stock requirements. Added operations are quickly accommodated simply by adding suitable valve sections.

For further information, write for Bulletin M5101A. 7852

VICKERS INCORPORATED
DIVISION OF SPERRY RAND CORPORATION
Mobile Hydraulics Division
ADMINISTRATIVE and ENGINEERING CENTER
Department 1474 • Detroit 32, Michigan
Application Engineering Offices: ATLANTA • CHICAGO CINCINNATI • CLEVELAND • DETROIT • GRAND RAPIDS • HOUSTON • LOS ANGELES AREA (El Segundo) • MINNEAPOLIS • NEW YORK AREA (Springfield, N. J.) • PHILADELPHIA AREA (Media) PITTSBURGH AREA (Mt. Lebanon) • PORTLAND, ORE. • ROCHESTER • ROCKFORD • SAN FRANCISCO AREA (Berkeley) • SEATTLE • ST. LOUIS TULSA • WORCESTER
IN CANADA: Vickers-Sperry of Canada, Ltd., Toronto, Montreal and Vancouver


You realize more
profits
when using L & L's new hydraulic fittings
PROFITS
"CN"
• Will stop hydraulic fluid leakage
• Will reduce maintenance . . . assembly time
METERING AND SHUT-OFF VALVE
• Rated for 5000 psi pressures
• Choice of outlets
• Simple maintenance
FLANGE FITTING
• Designed for quick installation
• Eliminates pipe thread connections
• Choice of wide selection of outlets
Other outstanding features:
"CN"
• Eliminates stress in valves, elbows and tees
• Can be positioned 405°
• No need for sealing compounds
• Excellent resistance to vibration
• Hex sizes are small to permit close openings for valves and other component parts
Metering and Shut-off Valve
• Stainless Steel stem
• Adaptable to straight or angle valves with male pipe, female pipe or tube connections
• O-ring only replacement part needed
• Available in sizes—⅛" to ¾"
Flange
• Adaptable to solid and swivel tube, pipe or weld connections
• Can couple together to make unions or clusters
All fittings available in a wide range of shapes, sizes.
Write for booklet, "How you Profit with L & L" . . . describing the savings you realize when using L & L fittings.
Member of NFPA
L & L MANUFACTURING COMPANY
Dept. A3, 8088 E. Nine Mile Rd., Van Dyke, Michigan

EQUALIZING CIRCUIT LEVELS A 675-SQ. FT. PLATEN

Concluded from page 71

rected to the bottom of each cylinder individually. Pressure created in the bottom ends operates pilot checks to connect the tops of the equalizer cylinders to tank.

The pressure switches in each equalizing line are part of a safety system. If the normal method of leveling is not sufficient to overcome an obstruction, pressure in the line rises until the pressure switch is actuated. This in turn actuates valve *G* to raise the platen.

The 40-gpm pump which supplies make-up fluid to the equalizer system also supplies the carriage system and can supply the platen cylinders in an emergency. When the platen must be held up for long periods, the main pumps can be shut down and the holding pressure maintained by this smaller pump delivering through valve *L* which is then actuated.

PRE-FILL BOOSTER SYSTEMS

The 26 cylinders which exert force on the moving platen have their head ends connected to tank through pre-fill check valves. The press is opened by applying pressure fluid to the rod ends of 8 of the cylinders. Just before the platen is raised, pilot pressure is applied to open the pre-fill check valves. Flow control valves in the pilot lines to the check valves insure slow opening of the checks with a resulting decompression of the 2500-psi fluid. Pressure-compensated flow control valves were selected so that decompression of all cylinders would take place at approximately the same time regardless of differences in operating force required to open the check valves.

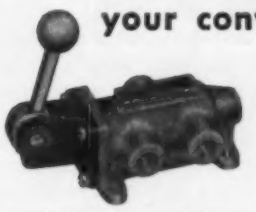
To accommodate the largest plate and yet prevent damage when smaller plates are being processed, the platen cylinders are arranged to apply force to three zones. Any combination of these zones can be selected by electrical control of three 4-way valves which connect fluid to the cylinders directly or through boosters. Sixteen of the cylinders serve the largest zone, and three boosters are connected in parallel to supply these cylinders. The remaining two zones are served by 6 and 4 cylinders respectively and each of these groups is supplied through a single booster.

The three directional valves in the booster circuits are supplied through pressure reducing valves with outlet pressures adjustable from 100 to 500 psi. This pressure can be applied to the cylinders by actuating the directional valves to bypass the boosters, or can be multiplied five times by use of the boosters. The pressure setting of the pressure reducing valves is adjusted by a remote, motor-operated relief valve connected to regulate pressure in the spring pocket. ▼▼▼

Schrader®...

your one source for AIR VALVES

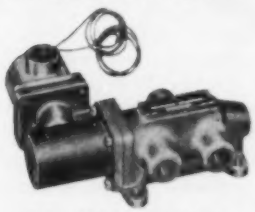
full line for every use—immediately available from your conveniently located Schrader Distributor



Hand-Operated Four-Way Valve

Foot-Operated Four-Way Valve

Pilot-Operated Valve



Solenoid-Operated Valve

Rotor Type Valve

Cam-Operated Valves

Flow Control Valves

Quick Exhaust Valves

Two- and Three-Way Poppet Type Valves with Roller Lever

CYLINDERS and everything you need in AIR ACCESSORIES
AIR CYLINDERS
Pivot Bolt Mounted Air Cylinder
Leg Mounted Air Cylinder
Base Mounted Air Cylinder
Air Hose Various Diameters

Schrader
a division of SCOVILL

Schrader's complete air products line can meet your every need.

A. SCHRADER'S SON • *Division of Scovill Mfg. Co., Inc.* • BROOKLYN 38, N. Y.

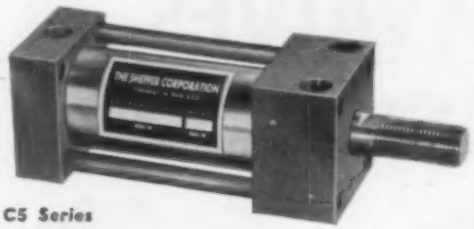
QUALITY AIR CONTROL PRODUCTS

CIRCLE 111 ON READER SERVICE CARD

CIRCLE 113 ON READER SERVICE CARD

SAVE...up to 50%

with this "FINEST of the INTERCHANGEABLES"!



C5 Series

- 250 psi Air—to 2500 psi Hydraulic
- 11 Bore Sizes—1⅛" to 14"
- Cartridge Quickly Removed Without Disassembly
- Sturdy Steel Head Construction
- Meets or Exceeds J.I.C.
- Interchangeable with Other Makes

Write, NOW, for Bulletin #357

SHEFFER

THE SHEFFER CORPORATION

Cincinnati 15, Ohio • Phone: VAlley 1-0320

Manufacturers of the industry's most complete line of air and hydraulic cylinders

SOLD BY LEADING DISTRIBUTORS NATIONWIDE

HOW MODIFIED VALVES

Continued from page 73

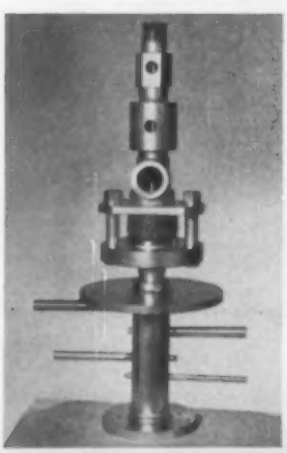
vent the carriage from lunging at the beginning of index.

Ordinarily, when pressure at the inlet port of this valve is relieved, the spring-loaded compensator spool moves to open the compensator orifice. If fluid is then suddenly directed through the valve, the compensator will allow an abnormally large pressure drop across the metering orifice until the compensator spool shifts. This results in a large initial slug of oil through the flow control valve, and consequent lunging of the controlled cylinders.

An extra port was added to the flow control valve as shown in Figure 2. When there is no flow through the valve, pressure applied at this port forces the compensator spool against the spring, closing the compensator orifice. On this machine, pressure is applied to this port when the INDEX valve centers and the INDEX cylinders move back momentarily. When the INDEX ADVANCE valve is actuated to relieve pressure from this port, the INDEX valve is also actuated, so that the flow control valve is then compensated by pressure at its inlet port.

In order to stagger the holes in each row, the machine has a half-index system. This sets the stop ratchet for each row of holes. Spacing between holes in the same row is controlled by the spacing of notches in the stop ratchet bar. Interchangeable stop ratchet bars with various spacings between the notches are provided. ▼▼▼

SIMPLIFY YOUR DESIGN BY USING 3&4 PASSAGE REVOLVING JOINTS



Available with 1, 2, 3 or 4 passages for handling:

- Compressed air
- Steam • Gas
- Hydraulic oil
- Oxygen • Propane
- Ethylene glycol
- Vacuum

ROTHERM revolving joints require no flexible hose. They are self aligning and operate with low torque.

WRITE FOR OUR EXPANSION JOINT CATALOGUE

Rotherm Engineering Co., Inc.

7280 W. DEVON AVE. • CHICAGO 31, ILLINOIS

CIRCLE 108 ON READER SERVICE CARD

ROTARY AIR GAST PRODUCTS

Runs without oil —

Model 3040 Oil-less Air Pump. Vac. to 20", pressure to 10 p.s.i. To 24 c.f.m., ¾ to 1½ h.p.

Oil-free air blast with carbon-vane

GAST AIR PUMPS

Other Oil-less Models

Built in six smaller sizes, some with integral motors — 1/12 to ⅓ h.p.

Need compressed air that's *absolutely free* of oil mist? A Gast Oil-less Air Pump may be your answer! Air flow *can't* contain oil vapor, because no oil is used.

You also eliminate lubrication problems when vacuum or pressure pump is mounted in a hard-to-service location.

Four carbon vanes lubricate themselves. Ball bearings are grease-sealed for life and separated from pump chamber by a ventilated space. Built in 7 models.

Write for Oil-less Bulletins 152A and VP-356.

GAST MANUFACTURING CORP., P.O. Box 117-D, Benton Harbor, Michigan.

See Catalog in Sweet's Design File

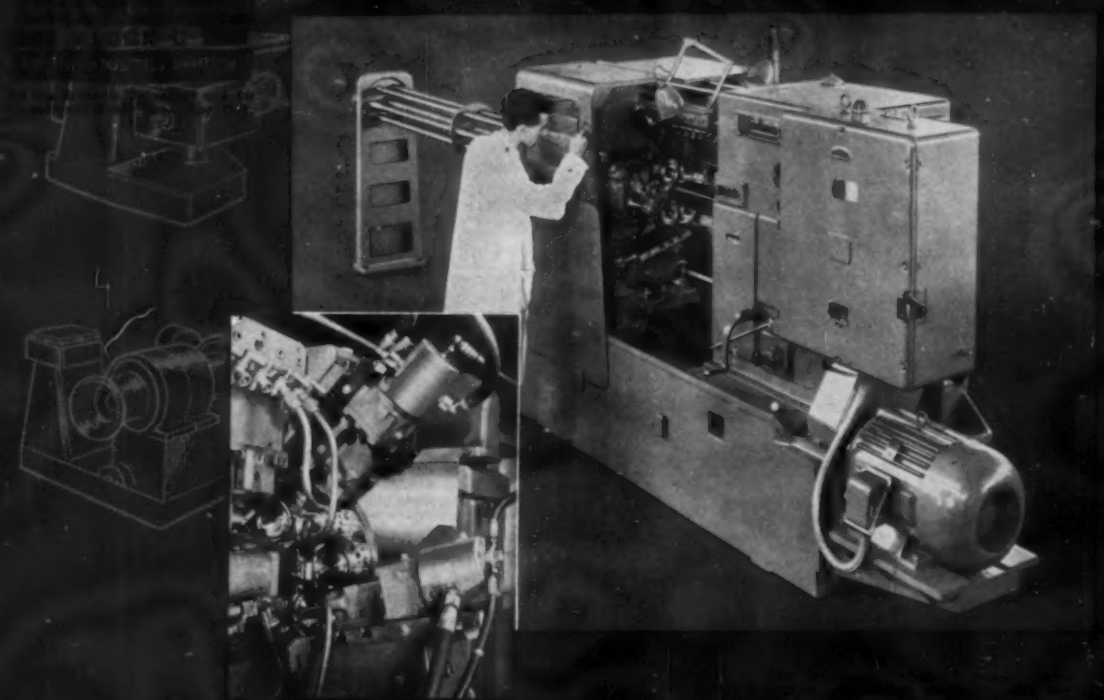
GAST ROTARY

"Air may be your answer!"

- AIR MOTORS TO 7 H.P.
- COMPRESSORS TO 30 P.S.I.
- VACUUM PUMPS TO 28 IN.

CIRCLE 49 ON READER SERVICE CARD

Keelavite HYDRAULICS



THE RECOGNISED AUTHORITY ON HYDRAULIC POWER TRANSMISSION

CIRCLE 69 ON READER SERVICE CARD

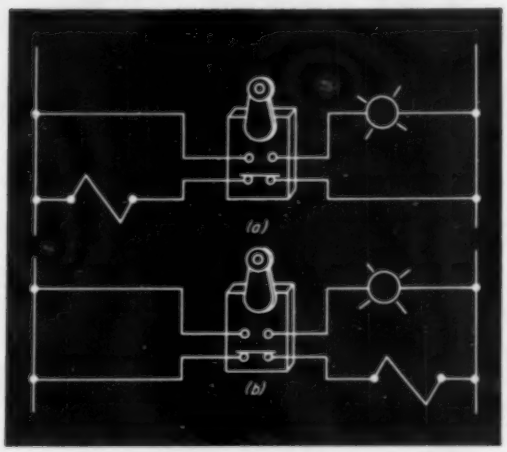
8 rules for using limit switches

• By D. Fitzpatrick
Allen-Bradley Co.
Milwaukee, Wisconsin

From 70 to 90% of electrical failures are caused by limit switches. Usually the fault is not the limit switch itself, but the way it was designed into the system. Here are simple rules to cut maintenance costs on your machines.

1 Don't connect contacts to opposite electrical polarities.

This is most important in the application of small, oiltight, snap-action, machine tool limit switches rather than the older devices. This rule is easy to follow; if ignored, it can lead to mushroom-shaped clouds of smoke. The correct way to connect limit switches is with normally open and normally closed contacts always on the same



side of relays, solenoids, or other energized devices. The instantaneous polarity is then the same on both sets of contacts.

Trouble in circuit *(a)* will not show up until the switch is actuated, because limit switches are usually rated for 600 volts. However, the normally closed set of contacts will draw an arc as soon as they open, and this effectively reduces the electrical clearance between the sets of contacts. If this arc stays long enough, it can cause a short circuit between the lines. In good engineering practice, all contacts are connected to one side of the controlled devices so that this situation should never exist. Some limit switches however are specifically designed for different polarities on their contacts.

2 Don't overload limit switches.

Designers often forget this common sense rule. It's incredible how many times we see a switch rated at 10 amperes continuous current come unglued internally because of overload. Invariably we discovered that the switch has been used directly in the power lines to a device such as a 10-ampere motor which might have an inrush current of 60 to 100 amperes. Limit switches, like relays, are rated for *pilot* duty, and that certainly rules out motors.

3 When actuation is slow, use a snap-acting limit switch

In a *slow acting* switch, the actuator is linked directly to the contacts. There is a danger that

This compact air cylinder with its built-in electric valve makes designing for air operation a lot easier and less costly
The Bellows Co.
Its close-coupled valve and single air connection means quicker response — better control

ONE QUICK LOOK TELLS YOU WHY THE BELLOWS AIR MOTOR OFFERS MORE VALUE TO USERS OF AIR CYLINDERS

As you can see, it takes but little more space, built-in valving and all, than a conventional air cylinder alone, without valve. Its single air connection (which can be inexpensive and easily installed flexible hose) makes it simple to install on moving machine elements. Its low voltage (8-12 v.) electrically controlled valve* permits less costly wiring, simpler hook-up, and easy interlock with related movements.

1013-B-1

Bellows Air Motors are fully described in Bulletin BM-25. It contains helpful data every methods man can use. We'll be happy to send you a copy without cost or obligation. Write Dept. AH-358, The Bellows Co., Akron 9, Ohio. In Canada, Bellows Pneumatic Devices of Canada, Ltd., Toronto, Ontario.

What you can't see in the picture is equally important. The Bellows Air Motor is built to rugged standards — to provide millions of cycles of trouble-free service. Yet if trouble should arise, there is a Bellows Field Engineer within easy phone call eager to help you.

Bellows Air Motors are built in five bore sizes: 1¼", 1¾", 2½", 3⅝" and 4½"; in any stroke length; and in six integral valve styles.

If your designs call for air operation, you'll be time and money ahead with the Bellows Air Motor.

The Bellows Co.

DIVISION INTERNATIONAL BASIC ECONOMY CORPORATION

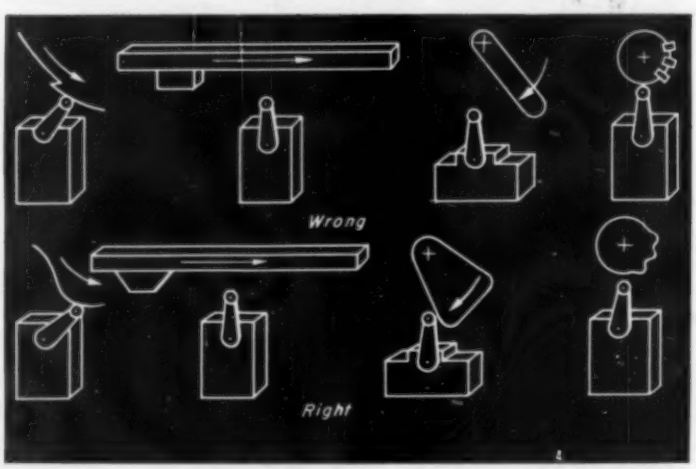
AKRON 9, OHIO

it may be operated so slowly that its normally closed contacts open, stopping the actuating member before the normally open contacts close.

A slow switch can sometimes be of great advantage. For instance, a safety overtravel limit switch may be tripped only once or twice in many years, yet if it *is* tripped, it must work. The contact mechanism may have become corroded or otherwise stuck from inactivity. A snap-action switch might not operate at all, and all emergency provisions would be lost. If a slow acting switch were used, the machine member would force the contacts open directly, or the whole switch would be peeled off its mounting!

In all other cases, expecially where the actuating motion is slow, the snap-acting switch is the best choice, because its contact action is very fast and independent of actuating speed.

4 Install limit switches so actuators are not struck or released suddenly.



One of the biggest causes of mechanical wear in limit switches is the stress at the first instant of mechanical contact. The mass of the actuator mechanism must be kept low. For this reason there has been an increasing use of small, oil-tight, machine tool limit switches.

Some designers believe that the older type limit switches are more rugged or will give longer life because they are larger. This is definitely not true. Smaller switches, properly used, have many times the mechanical life of their larger ancestors.

In addition, the rate at which the operating force is applied is important, and carefully inclined cams should be used.

If a limit switch is suddenly released after being actuated, it may be re-actuated when it flys back past its operating point. This depends on the distance the actuator was moved and its mass. Some limit switches have nylon rollers to minimize this flyback.

5 Be sure the limit switch is actuated long enough.

It usually takes about 1/5 second for a limit switch to actuate relays, solenoid valves, and other devices. Sometimes, after a machine has been built and is running well, someone decides to increase production by speeding up the cycle. The machine may work badly because limit switches are operated so fast that their associated devices do not have time to operate.

Remember also that the operating point and the reset point of a limit switch are not the same. Enough return motion in the operating member must be allowed to insure reset of the limit switch after an operation.

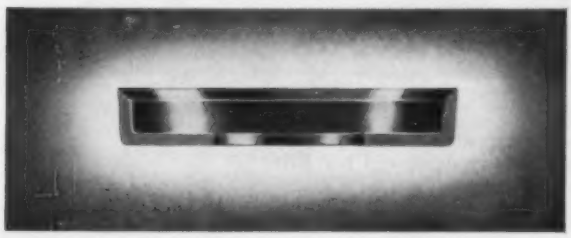
6 Don't use a limit switch as a mechanical stop.

One of the most pathetic sights is a brave little limit switch also being used as an anvil. A limit switch should never be driven past its safe overtravel point, and certainly not to its mechanical limit. We have often been told that the machine tool limit switch was not rugged enough for some particular application, only to find that it was being used as a mechanical bumper, or that some 200-lb electrician was doing a tribal dance on it! These switches are very durable, but not this strong, and substituting a larger switch won't help.

A limit switch should not be struck by the work

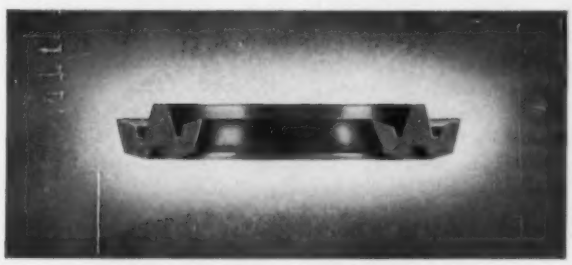
Simplify your sealing problems...

with Johns-Manville Precision moulded packing designs for pressure applications in hydraulic and pneumatic equipment

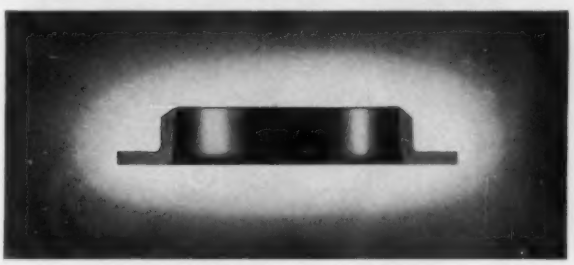


1. Type "A" Packing Cups for pistons
(the original "square heel" cup design)

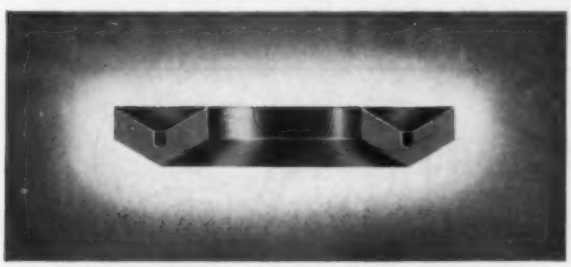
2. Sea Ring packing for rods



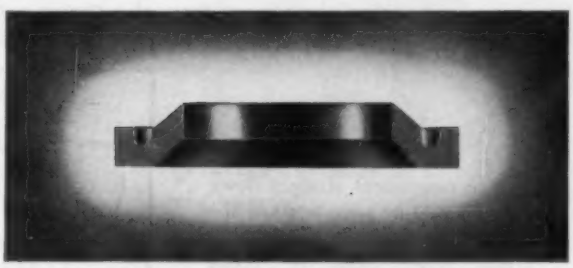
3. Uneepac Packing for rods and pistons



4. Hat Cup Packing for rods



5. V-Rings packing for rods and pistons



6. Cumpac #239 packing for rods

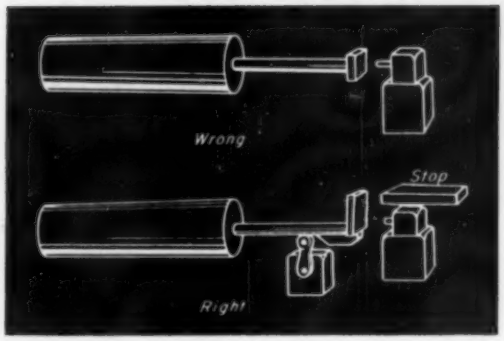
7. U-Cup Packing for rods and pistons

THE WIDE VARIETY of Johns-Manville Packing designs enables you to handle practically any sealing problem. The designs shown on this page are obtainable in a broad range of standard sizes and in materials designed for either usual or special service conditions encountered in hydraulic and pneumatic equipment. Johns-Manville also produces oil seals, moulded gaskets and miscellaneous shapes to specification. See your local J-M distributor or J-M sales office for product or engineering data. Or write Johns-Manville, Box 14, New York 16, N.Y. In Canada, Port Credit, Ontario.

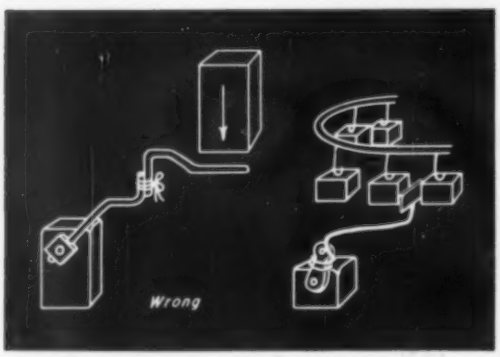
JOHNS-MANVILLE JM PRODUCTS

Johns-Manville MOULDED PACKINGS

in process. There may be certain cases where the work is always uniform in size, shape, and position, and may satisfactorily trip a limit switch. However, too many conveyors, for instance, carry large pieces, swinging wildly from overhead, and these pieces are expected to operate limit switches. Let some well-mounted machine element hit the limit switch.



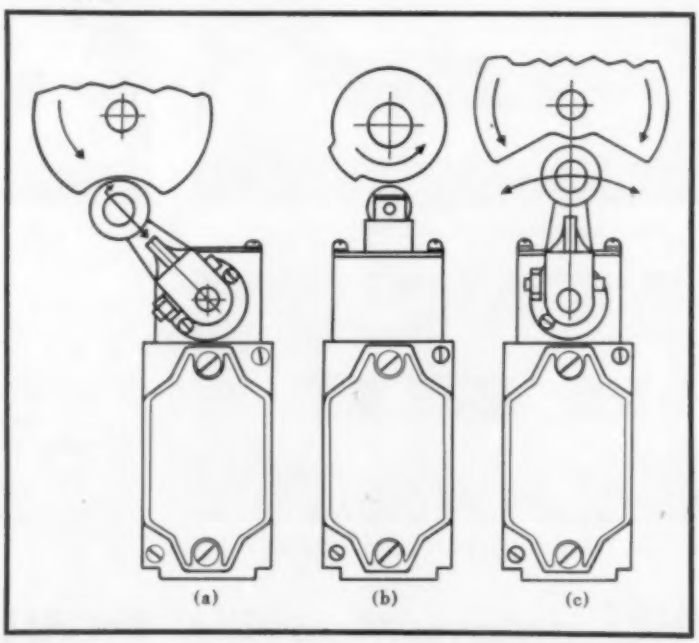
7 Don't add heavy or extra long actuators to limit switches unless they were specifically designed for this.



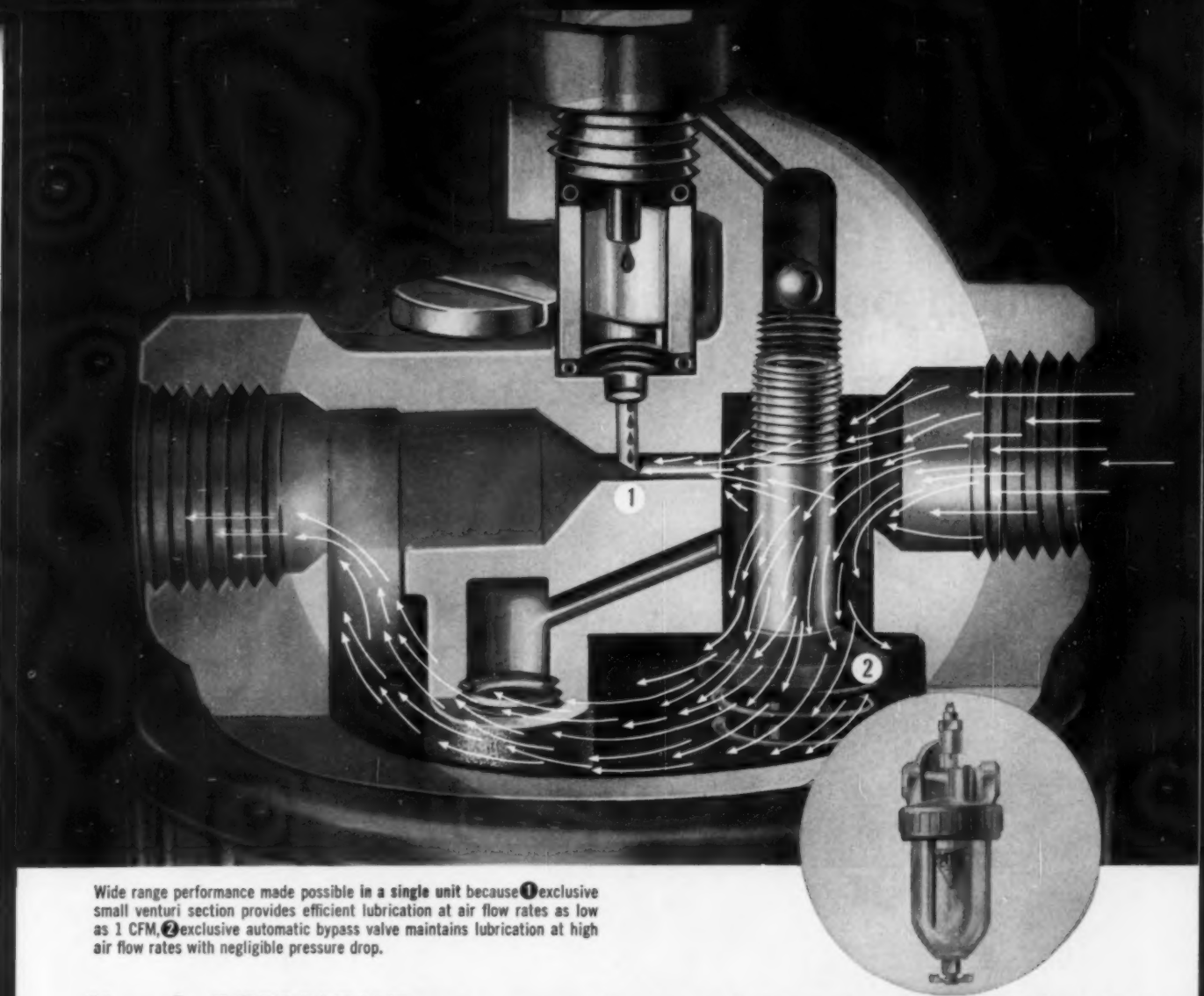
If an actuator is too long, it may either trip the switch out of sheer weight, or the switch may fail to reset. Some of the 12-ft. extensions which have been added to limit switches to grope around corners are fearful and wonderful to behold, but they are generally most unsatisfactory. The solution is to make the complicated actuating mechanism a part of the machine, instead of a part of the switch. The resulting inprovement in limit switch life and reliability is astounding.

8 Select the proper type of actuator according to the operating force.

In *a* the cam force has a large component straight down the actuator arm against the bearing, so that this little shaft will either bend or break quickly. A good push roller mechanism is shown in *b*. Any mechanism pushing horizontally at or below the center of the roller wheel will cause trouble. Each application should have at least an elementary kinematic study to insure that operating forces are in a constructive and useful direction. View *c* shows a well designed actuator for a roller arm.



CIRCLE 142



Wide range performance made possible **in a single unit** because ❶ exclusive small venturi section provides efficient lubrication at air flow rates as low as 1 CFM, ❷ exclusive automatic bypass valve maintains lubrication at high air flow rates with negligible pressure drop.

Now! EFFICIENT pneumatic equipment LUBRICATION AT ALL AIR FLOW RATES

Enough oil — but not too much. A fine mist at *any* flow rate . . . ultra-fine, enduring atomization that assures *efficient* lubrication. Tools, chucks, cylinders, other air equipment function smoothly at *any* speed when lubricated by Watts air line lubricators.

You get optimum efficiency from these advanced-design units because Watts has *specialized* in protection and control devices since 1875. Exclusive features and precision construction assure reliable, lowest-cost performance.

WATTS FILTERS — exclusive "TORNADO ACTION" provides really clean dry air

Filter life is extended by extreme centrifugal force which spirals dirt and moisture particles downward into "quiet zone", leaving only a minute percentage of the finest and lightest particles to be trapped by the filter cone.

WATTS REGULATORS — sensitive "Aspirator Action" maintains more uniform pressure

Aspirator acts directly on diaphragm giving instant compensation for fluctuating load demands . . . provides precise control and stabilizes pressures reaching individual pieces of equipment.

Write for free technical catalog. Charts, diagrams, performance data enable you to specify the right Watts pneumatic equipment right on the spot!

WATTS

FILTERS
REGULATORS
LUBRICATORS

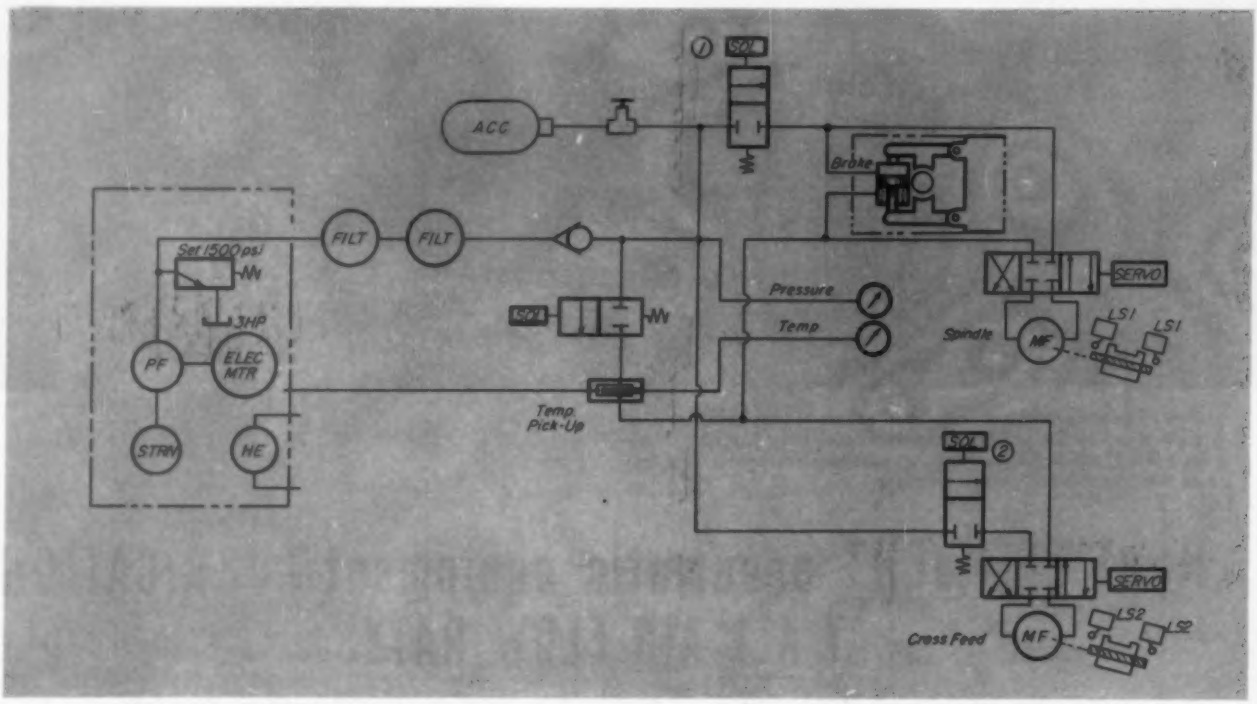
YOUR SAFE SPECIFICATION

Watts Regulator Company — Industrial Division — 6 Embankment Road — Lawrence, Massachusetts

Tricky machining requirements led to the development of a servo controlled cam milling machine. Successful operation for three years proves . . .

High performance servos can be used on machine tools

• By S. F. Watanabe, *Senior Engineer, Bendix Aviation Corp., Research Laboratories, Detroit, Mich.*



FINER FILTRATION, higher operating pressure, and servo controlled valves make this machine tool circuit different from those generally used.

CAMS are being cut to an accuracy of .001 inch and a reproducibility of .0002 inch on a machine using an electro-hydraulic servomechanism. This machine, built in 1954, was Bendix's first practical application of high performance electro-hydraulic servos for a machine tool. Several larger milling machines have since been built using the same principles of servo design.

The cam machine resembles a lathe. One fluid motor drives the work spindle and carriage feed screw. A second fluid motor drives the cross-slide feed screw. Servosystems control the speed of the spindle drive and position of the cross-feed drive.

• **Operation**—First, a punched tape on a reel is loaded in the control unit. Next, a cam blank is placed on the work spindle arbor and locked in place. The cutting tool is then moved to its initial position by manually moving the cross-slide. Cutting of the cam is then automatic, complete instructions being supplied by the tape.

In a typical cam machining operation, the spindle hydraulic motor is operated at 180 rpm to give a work spindle speed of 10 rpm and a carriage feed rate of 0.1 ipm. The cross-feed motor rotates at 150 rpm which corresponds to 30 ipm.

Although the feeds and speeds are small com-

CIRCLE 100 ⟶

COUNTDOWN!

Every Parco O-Ring reflects the rubber compounding and manufacturing skill Parco's engineers have accumulated since the development of this type of seal. The design engineer working with the most complicated missile/rocket designs...or in more mundane manufacturing...can count on dependable dynamic and static seals through the widest possible range of pressures and temperatures. Parco O-Rings delivered on time from inventory or custom moulded assure money-saving and performance-improving operations. For a successful launching of your product, call the Parco engineering representative in your 'phone book or write Parco's Engineering Division. Write today for your free copy of the new Technical Data Reference Log #1581.

PLASTIC AND RUBBER PRODUCTS COMPANY, 2100 HYDE PARK BLVD., LOS ANGELES 47, CALIF.

pared to later machines, the servo design problems are similar.

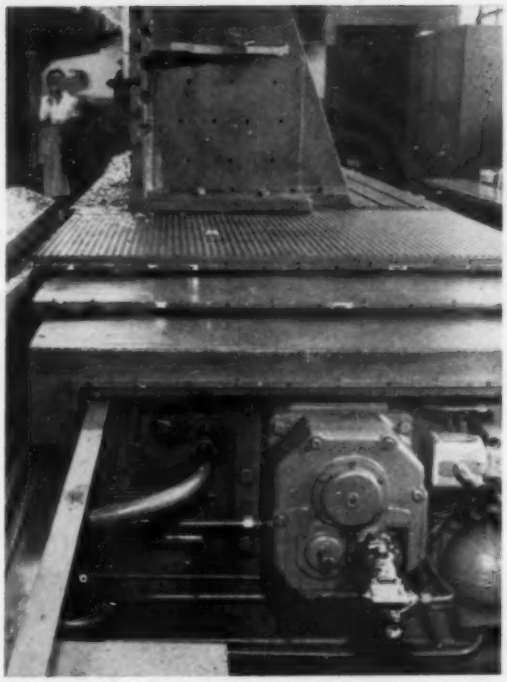
• **Servo considerations**—To select hydraulic components, these requirements are important:

1. Cross-feed servo must have fast response. A high torque-to-inertia ratio is most important.
2. Spindle and cross-feed servos must work smoothly at all speeds from nearly zero to very fast.
3. It must be possible to stop the machine for tool changes and not lose position synchronization between the cross-slide and spindle, even with the hydraulic power off.
4. If machining error gets too big, the machine must shut down without damaging itself and with minimum damage to the work.
5. Feed drives must be reliable and need little maintenance.

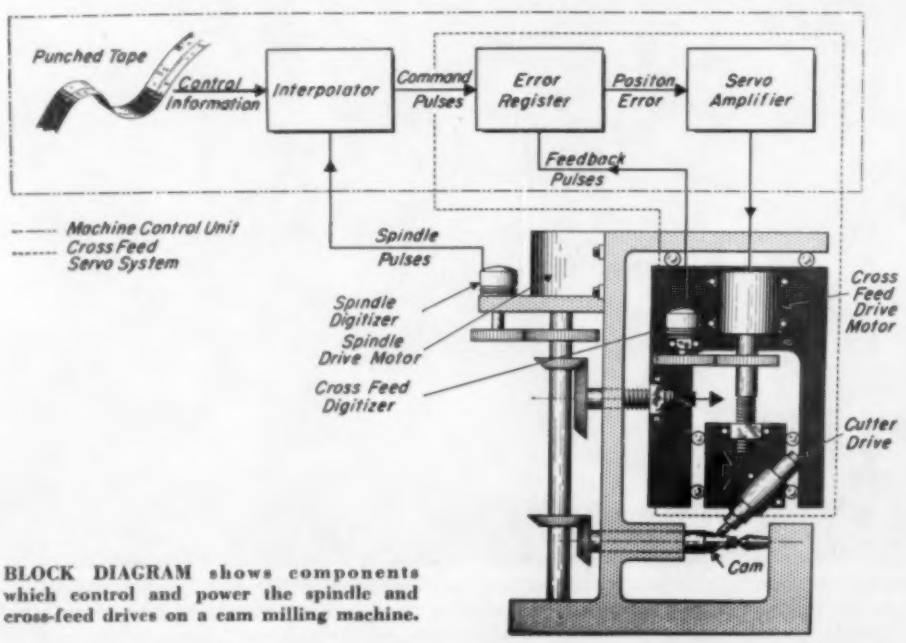
The hydraulic circuit shown schematically meets these requirements.

• **System design**—Oil at 1500 psi drives the feed motors. The oil is double filtered to give reliable operation of the servo valves. A fast action d-c solenoid shut-off valve placed upstream to each of the servo drive motors stops the feed instantly when limit switches are tripped, or error becomes excessive. The brake, which clamps on the double worm shaft, prevents rotation and consequent loss of synchronization of the work spindle and cross-slide when hydraulic power is shut off during tool change.

Concluded on page 102



LARGE MILLING machines now have servo controlled feeds. Fluid motor and close-coupled servo valve are shown in the foreground.



BLOCK DIAGRAM shows components which control and power the spindle and cross-feed drives on a cam milling machine.

protecting products the Caplug way
can save you hundreds $$ . . . for pennies spent

quick to put on...and quick to take off...fit tremendous variety of tubing, threaded fittings and machined parts

Caplugs

take your pick from this big closure family
...10 standardized styles...over 500 sizes in stock

molded of flexible Polyethylene
... won't chip, break, shred or collapse

get a free handful of Caplugs like this
in exchange for the coupon below

tough enough to take abuse
...yet, most kind to threads and polished surfaces

CAPLUGS DIVISION, PROTECTIVE CLOSURES CO., INC.
2203 Elmwood Ave., Buffalo 23, N. Y.

Mail a free assortment of Caplugs, literature and prices to us, without obligation.

NAME _____ TITLE _____

FIRM _____

ADDRESS _____

CITY _____ ZONE _____ STATE _____

CIRCLE 104 ON READER SERVICE CARD

REPUBLIC VALVES
FOR EVERY INDUSTRY

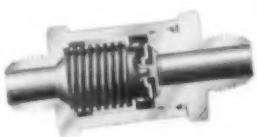
CHECKS

THAT FILL YOUR NEEDS

MINIATURE CHECKS

Mini-Valve — Regular Size Valve

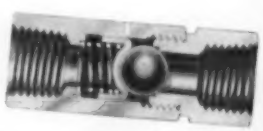
Save weight and space with Mini-Valves. They have same rated flow as regular size, but are only ¼ the size and weight. Good pressure drop characteristics. Temp. range −65° to plus 400°F. Operating pressure to 5000 psi. One-piece stainless steel body, in tube sizes 4 to 16 (¼" to 1" O.D.) Meets or exceeds requirements of MS MIL-V-25675. Port threading MS33514 flareless.



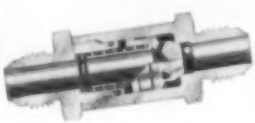
FREE-FLOW CHECKS

Extremely low pressure drop, with wide open flow. Molded elastomer seal and spherical seat prevent leakage at any pressure. Sizes ⅛" to 2" in brass and aluminum alloy up to 3000 psi, and stainless steel to 4000 psi. Opens at 2 psi. Temp. range −65° to 200°F. Pipe, internal straight thread and flared tube connections standard; MS33514 flareless available.

BALL CHECKS



Ruggedly constructed for intermittent non-shock hydraulic service up to 500 psi at temperatures −65° to 350°F. Sizes ⅛" to ¾". Brass, aluminum alloy, stainless steel. Pipe and flared tube connections.



HY-PRESSURE CHECKS

Built for continuous service in high velocity systems at pressures up to 5000 psi in steel and stainless steel, and 3000 psi in aluminum alloy. Low pressure drop. Metal-to-metal seal. Operating temperatures −65° to 250°F. Sizes ⅛" to 2", with pipe, internal straight thread and flared tube connections. MS33514 flareless available.

Distributors in principal cities coast to coast

RM REPUBLIC MANUFACTURING CO.
15655 BROOKPARK ROAD • CLEVELAND 11, OHIO

CIRCLE 105 ON READER SERVICE CARD

HIGH PERFORMANCE SERVOS

Concluded from page 100

Total inertial load of the cross-feed drive including the internal inertia of the motor is .0043 lb-in/sec². The hydraulic natural frequency of this system was predicted to be 180 cps. Actual measurement put it at 140 cps. Non-linearities and errors in determining the volume of oil under compression between the valve and motor account for the error.

Of the total inertia load of .0043 lb-in/sec² on the motor, the inertia of the cross-slide is .0016 lb-in/sec². The small load compared to the drive inertia allows a high frequency response without measurable interaction with the structure vibrations.

Servo valve life has been two thousand hours. They were originally designed for missiles. Valves designed specifically for machine tool control application are now being used. They should last even longer.

The only unusual maintenance is extra good oil filtering and special care in keeping the system clean. Before the machine went into operation, the hydraulic system was thoroughly flushed with hydraulic fluid and the filters changed, new hydraulic fluid was filtered through five-micron filters while being pumped into the reservoir. In regular operation, only the upstream filter in the series filter arrangement is changed regular about once a month. The second filter is used for three months or more. ▼▼▼

UP TO 3.5:1 MECHANICAL ADVANTAGE AUTOMATICALLY!

DOUBLE ACTING
Toggle Linkage Hand Pumps

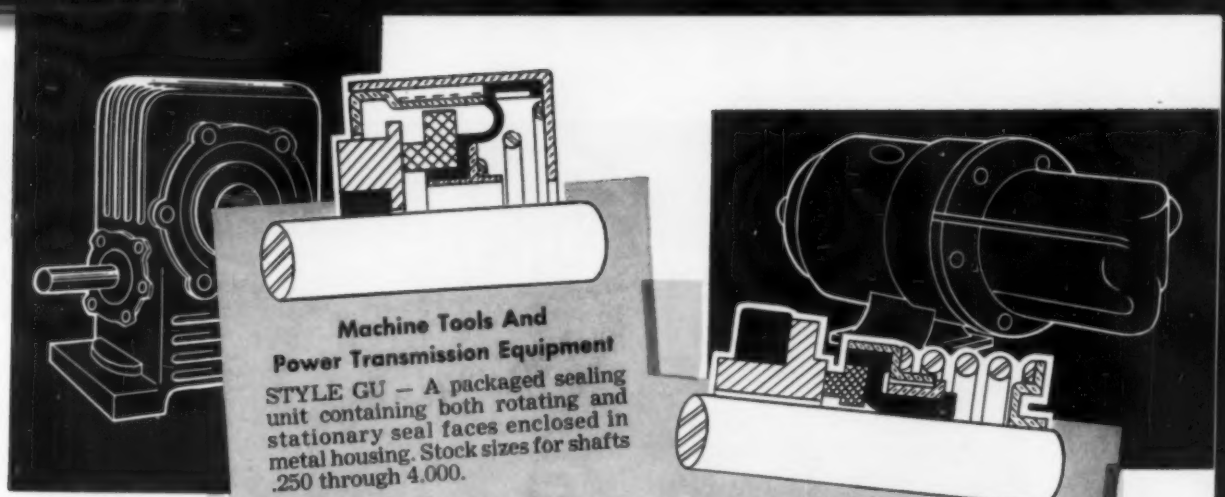
Just select the proper portion of the stroke
Models for 1000, 3000, and 10,000 P.S.I.
Hydraulic pumps, needle valves, 4 and 5 way valves, electric pumps, hydraulic wheels.

Write Dept. AP-3

MECHANISMS CO.
118 E. 2nd St. • Uhrichsville, Ohio

CIRCLE 85 ON READER SERVICE CARD

CIRCLE 50 →



Machine Tools And Power Transmission Equipment

STYLE GU — A packaged sealing unit containing both rotating and stationary seal faces enclosed in metal housing. Stock sizes for shafts .250 through 4.000.

Pumps And Compressors

ROTO-FLEX — Rugged flexibility. Only 3 parts. Single or double units. Stock sizes for shafts .250 through 4.000.

STYLE RFO — A specially designed Roto-flex seal, for installation outside the stuffing box. Stock sizes for shafts .250 through 4.000.

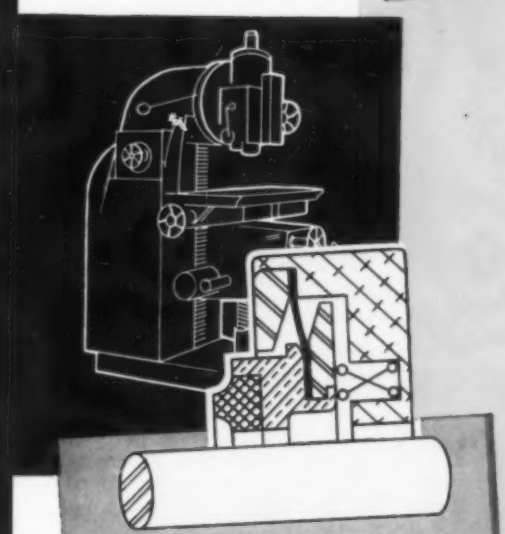
A Complete Line GITS SHAFT SEALS For Every Application

These modern, mechanical, face-type seals are carried in stock — to save you time and money. Write for detailed data.

GITS BROS. MFG. CO.

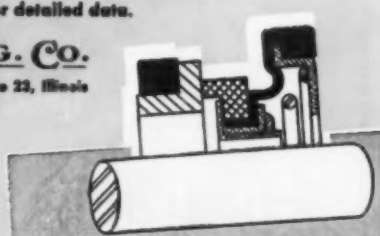
1864 South Kilbourn Avenue • Chicago 22, Illinois

Specialists In Lubricating Devices And Shaft Seals For Almost Half-A-Century



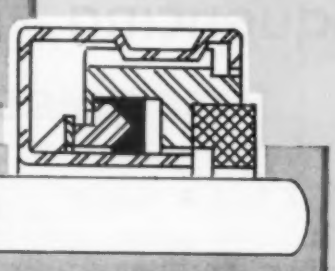
Heavy Machine Tools

STYLE DPC — A high-speed, carbon-faced seal, for more compact installation in heavy industrial machinery. Stock sizes for shafts .250 through 4.000.



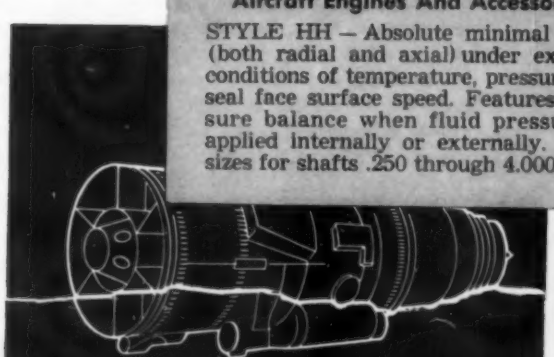
Household Appliances

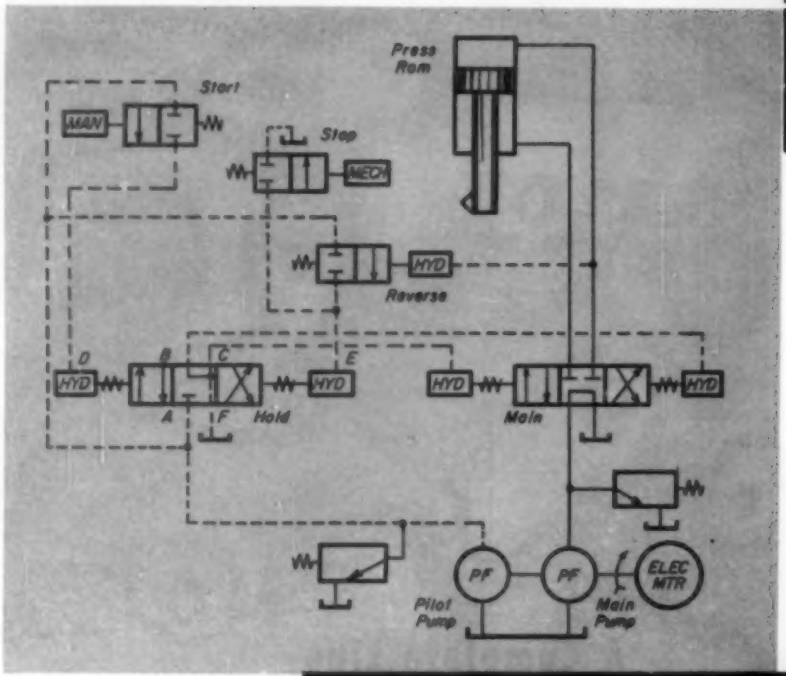
STYLE SGU—A factory-assembled unit-type seal for the small-budget user. Stock sizes for shafts .250 through 1.000.

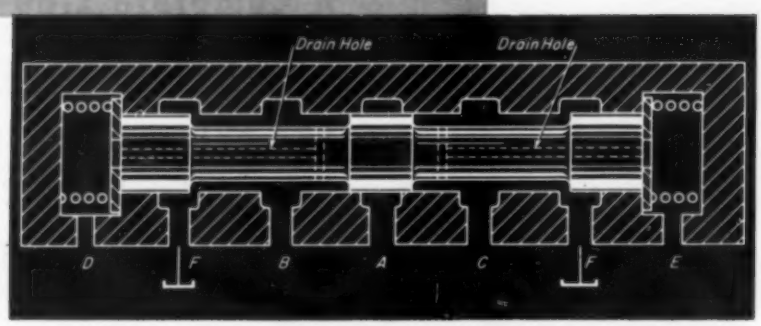


Aircraft Engines And Accessories

STYLE HH — Absolute minimal space (both radial and axial) under extreme conditions of temperature, pressure and seal face surface speed. Features pressure balance when fluid pressure is applied internally or externally. Stock sizes for shafts .250 through 4.000.







Hydraulic sequencing gives fast action

• By J. R. Fawcett

PILOT operation of valves can be faster than electrical operation, especially where larger valves would require solenoid control with pilot operation. This all-hydraulic sequencing system has been applied to a coining press to give fast, automatic operation over one cycle.

In addition to the main pump which is unloaded through the MAIN valve at the top of the ram stroke, smaller pump supplies constant delivery for pilot pressure. This is maintained continuously with excess fluid blowing off through the relief valve.

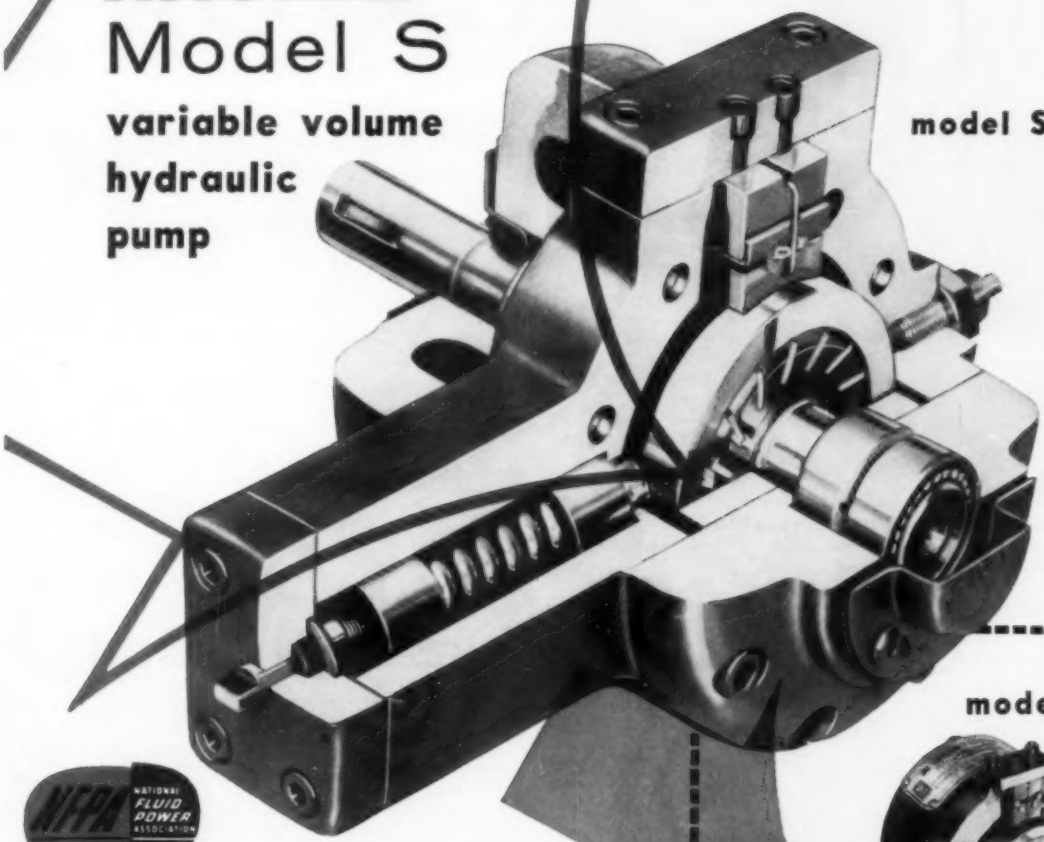
• **How it works—** When the START valve is operated, pilot oil flows to the left end-chamber of the HOLD valve and shifts the valve spool to the right against the spring. The drain hole is small enough relative to pilot-pump delivery so that pressure builds up in the end-chamber to move the spool. Pressure fluid is connected from port *A* to port *B* shifting the MAIN valve, so that the ram descends. Pressure fluid is also connected through the drain hole to the left end-chamber, so that when the START valve is released, the HOLD valve spool is locked in position.

Concluded on page 108

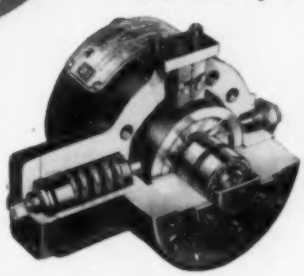
new!

RACINE Model S

variable volume hydraulic pump



NFPA NATIONAL FLUID POWER ASSOCIATION Member



10 gpm-1000 psi-1800 rpm

Here is the "big brother" to the popular Racine Model Q (5 gpm-1000 psi) pump. Both of these pump models answer the needs of builders of quality equipment for accurate control with extremely high circuit efficiency.

Compact design — only 7⅛" long, 6" wide and 4¾" high, makes the Model S ideal for use in areas where space conservation is essential.

When Racine-Seco pumps are used in combination, specifications of 1-1/2 gpm to 70 gpm at pressures up to 10,000 psi are available.

Write for brochure PB-2 which contains complete descriptive literature. Take advantage of Racine's FREE engineering service.

VARIABLE VOLUME *Racine variable volume principle steps up production by extending tool life and increased overall machine efficiency. Saves horsepower.*

CONTROL *A built-in volume control provides adjustment of pump displacement for exact circuit requirements — a feature that reduces motor size.*

GOVERNORS *Both the standard Model S and Model Q utilize the Racine pressure compensating governor. Special governors and governor springs are also available. No relief valves necessary.*

MOUNTING *Standard JIC subplate design for simple installation and maintenance.*

RACINE SECO

RACINE HYDRAULICS & MACHINERY, INC.

2074 Albert Street RACINE, WISCONSIN

Simplex Engineering Company, Subsidiary, Zanesville, Ohio

FIG. 1. Key to simplicity and competitive cost of this earth drill is the combination of fluid motor drives with mechanical speed control.

Putting power where it's needed, in a small convenient package, led to the selection of fluid motors for an earth drill. Coupling the motor to the drill through mechanical transmission components produces a simple, rugged machine.

Gear motors drive earth auger

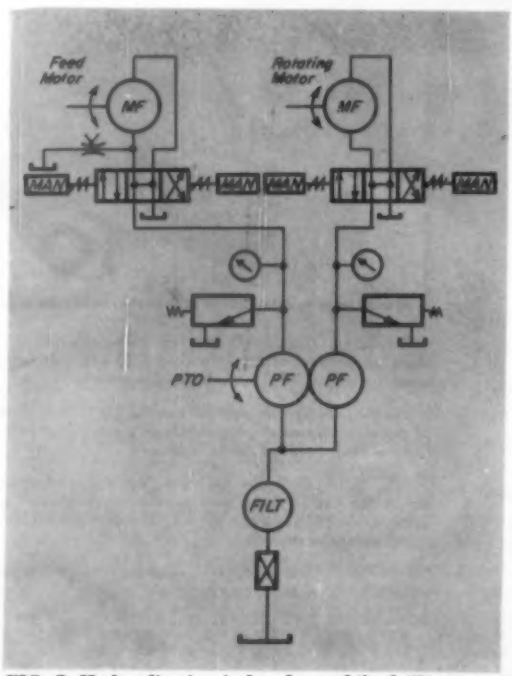


FIG. 2. Hydraulic circuit for the mobile drilling unit.

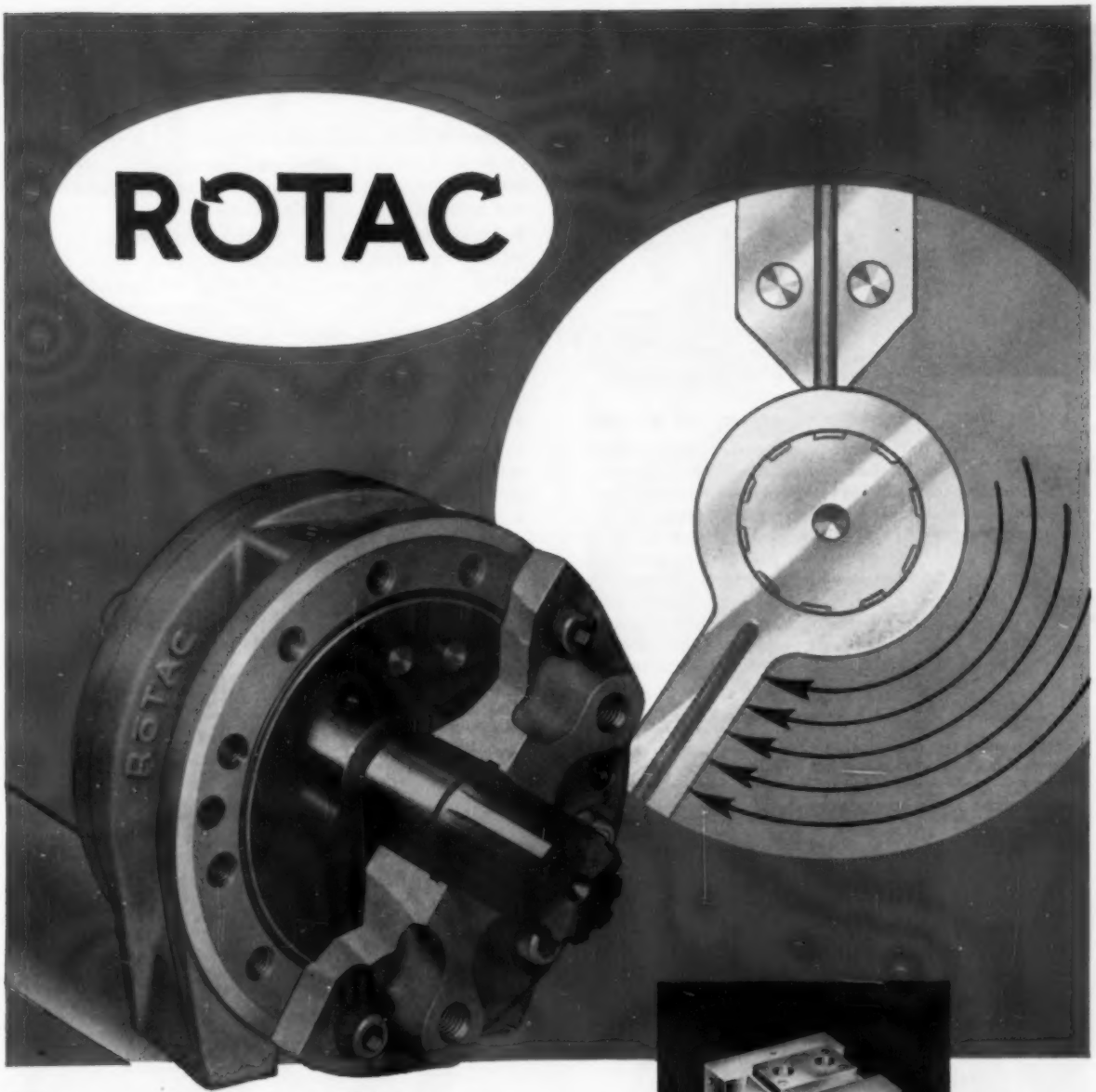
• By J. A. Swanson, *Chief Engineer*
Oliver Hoff, *Project Engineer*
Edward Srnensky, *Development Engineer*
Mining Div., Cardox Corp., Chicago

A PORTABLE, truck-mounted earth drill, working at any angle—from horizontal to vertical—and taking its power from the engine, uses fluid motors to turn and feed the auger. Fluid power was best because it led to the simplest design having these advantages:

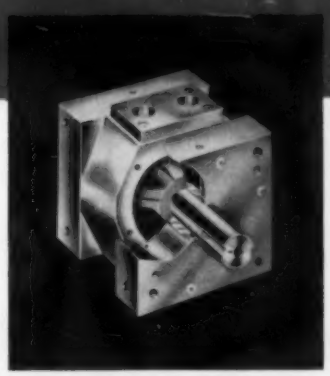
1. Pump and controls mounted on the truck
2. Flexible hoses transmit power no matter what the drill position
3. Whole unit removable from truck bed for drilling horizontally at other heights; again hoses make it possible
4. Connected by hoses, control valves can be placed conveniently.

Having decided to use hydraulics, the next step was to pick the most rugged and economical ways to vary speed and feed in order to keep manufacturing and maintenance costs low. The hydraulic circuit, Figure 2, uses rugged, low cost, fixed-dis-

Continued on page 108



Tremendous Torque in Small Space



If you are at all concerned with an operation involving power transmission, you owe it to yourself to investigate this new name in reciprocating torque actuators: Rōtac.

The name, Rōtac, may be unfamiliar to you because of its very newness—but the name (and reputation) of Ex-Cell-O should excite your interest. Even now, Rōtac reciprocating torque actuators are performing such operations as clamping, indexing, lifting, revolving, lowering, extending, retracting, closing, opening, oscillating and turning, on a wide variety of machinery.

FREE LITERATURE

If you move *anything*, then you'll want detailed information on Rōtac. Learn how this rotary power is used throughout industry in thousands of applications. Complete with photos, schematics, engineering data, etc. 57-59

XLO
EX-CELL-O FOR PRECISION

GREENVILLE PLANT, GREENVILLE, OHIO

EX-CELL-O CORPORATION

EX-CELL-O PRECISION PRODUCTS INCLUDE: MACHINE TOOLS • GRINDING AND BORING SPINDLES • CUTTING TOOLS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT

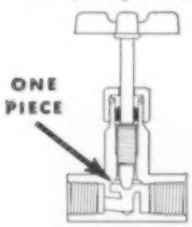
CIRCLE 80 ON READER SERVICE CARD

MARSH
Needle Valves

MAXIMUM WORKING PRESSURE 10,000 PSI

. . . for finer regulation of water, oil or gas

First needle valve to combine all the characteristics called for in modern industry. Embodies sturdiest basic construction—machined from solid bar stock—suitable for pressures to 10,000 psi and equally efficient in lower range. Note stem guide fused to body by new "Conoweld" process, eliminating faults of conventional two-piece valves. Stem 416 stainless steel. Stem threads fine pitch for strength and micrometer regulation. Body electro-zinc plated. Sizes ⅛" to 1", globe and angle patterns.



Ask for new Needle Valve Catalog

MARSH INSTRUMENT CO. *Sales Affiliate of Jas. P. Marsh Corp.* Dept. 19, Skokie, Ill.
Marsh Instrument & Valve Co. (Canada) Ltd., 8407 103rd Street, Edmonton, Alberta, Canada

HYDRAULIC ENGINEERING
FOR INDUSTRY

CARDWELL
TRADEMARK SINCE 1829

DESIGN SERVICES
FABRICATION
POWER UNITS
HYDRAULIC PANELS
ELECTRICAL CONTROL PANELS
ACCUMULATORS
STOCKING DISTRIBUTORS
HYDRAULIC COMPONENTS

Complete Engineering and Design Services Are Available. Qualified Sales and Service Engineers in Most Areas.

The CARDWELL MACHINE COMPANY
Quality — A CARDWELL TRADITION SINCE 1829
Franklin at 19th St., Richmond 11, Virginia • Phone 7-4593

GEAR MOTORS DRIVE EARTH AUGER

Continued from page 106

placement pump and motors. Speed is controlled by a flow control valve and mechanical power transmission elements, a wedding of mechanical and hydraulic speed varying units.

• **Operation**—The auger is turned by a hydraulic motor connected to a three-speed gear reducer giving drilling speeds of 100, 200 or 300 rpm. The auger is fed by another hydraulic motor connected to a lead screw by sprockets and chain. Feed rate can be changed by using differently pitched lead screws, other sprockets, or by changing the feed motor's speed by bypassing inlet fluid. By keeping the hydraulic motors and circuitry off the mast, its weight was kept to only 650 pounds; light enough for two men to slide or rotate it into position on the mounting tube.

• **Hydraulic system**—A dual section pump sends fluid under pressure to the rotating and feed motors. Seven and a half gpm is supplied to the feed motor, 16 gpm to the drill rotating motor. Separate relief valves are set at 2000 psi. Pumps are vane type. Feed and rotation control valves are four-way, three position, manually-operated, spring centered types. Since the machine does not require holding when the valves are in the center or *off* position, open-center valves automatically unload the pumps when the motors are not running.

Rotation and feed motors are vane type. Feed motor output is 5 hp at 2000 psi and 5 gpm. Rotation motor output is 22 hp at 2000 psi and 22 gpm. Both can be reversed by reversing oil flow by means of four-way valves. A needle valve controls feed motor speed by bypassing fluid to tank. This valve is connected to the side of the motor which is the inlet during downfeed; therefore, the valve affects motor speed only during downfeed and has no effect when rotation is reversed. ▼▼▼

HYDRAULIC SEQUENCING

Concluded from page 104

When the ram meets the work, system pressure builds up until it reaches the setting of the REVERSE valve. The REVERSE valve then shifts and connects pilot fluid to port *E* of the HOLD valve. Pressure on both ends of the valve spool is now equal. Since the right spring is compressed, it forces the spool to the left. Oil from the left end-chamber flows through the drain hole, port *A* closes, this fluid passes to drain through port *F*. When the spool completes its stroke to the left, it is maintained the same as before.

Shifting the HOLD valve to the left also shifts the MAIN valve, so that the ram retracts. As soon as the ram moves away from the work and system pressure falls, the REVERSE valve returns to its

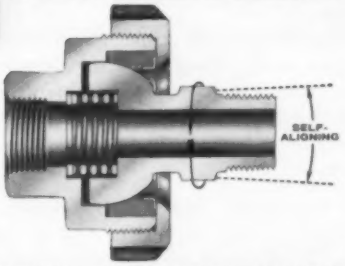
Concluded on page 110

CIRCLE 17 ON READER SERVICE CARD

BARCO

Self Aligning SWIVEL JOINTS

—when you need swivel joints in



HYDRAULIC PIPING

Send for Engineering Catalog 265C

SELF-ALIGNING—Provides a wide tolerance for pipe fitting and machine alignment. Saves endless hours installation time and permanently protects against binding and wear.

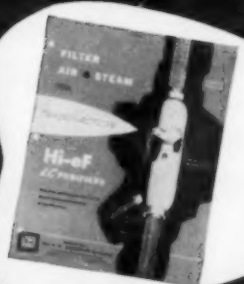
SELF-ADJUSTING SEAL—Pressure sealing and automatically self-adjusting for wear. Ideal for hydraulic service. Uniform performance over wide temperature range. Long life. No lubrication needed.

Send for Catalog 265C, "Barco Self-Aligning Swivel Joints." Ratings as high as 3000 psi hydraulic. Sizes ¼" to 2"; 90°, 180°, or straight styles. *Ask for recommendations.* BARCO MFG. CO., 532D Hough St., Barrington, Illinois.

---

see the latest in

AIR AND STEAM CLEANERS



send for

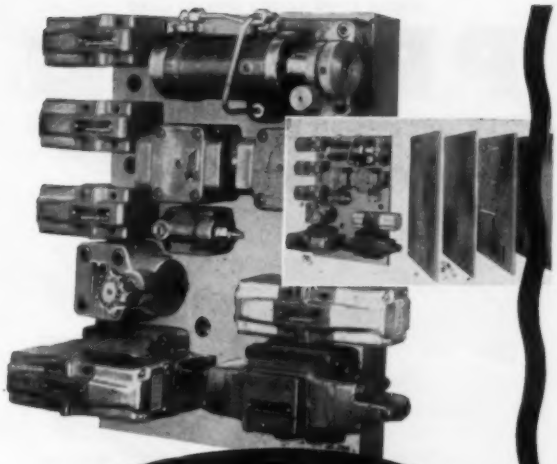
ANDERSON'S NEW Hi-eF CATALOG *FREE*

● Here is complete data on revolutionary Hi-eF air and steam cleaners. These astounding devices require no maintenance whatsoever. They have no troublesome filters to replace. Moisture and foreign particles are removed from pipelines by centrifugal force without the use of any moving or replaceable parts. Prolong the life of all pneumatic and steam equipment. Low cost. Mail reader service card for free copy of Bulletin 502 today!

ANDERSON Hi-eF PURIFIERS

THE V.D. ANDERSON COMPANY
division of International Basic Economy Corporation
1936 West 96th Street • Cleveland 2, Ohio

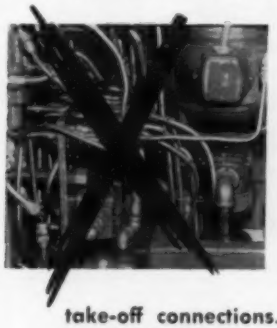
CIRCLE 12 ON READER SERVICE CARD



ALMO

HYDRAULIC CONTROL MANIFOLDS

CONTROL SYSTEMS READY FOR OPERATION—NO CIRCUITS TO PONDER OVER AT INSTALLATION



Leading machine manufacturers use these manifolds to cut costs and obtain permanent trouble-free operation. Send your hydraulic circuit print and sketch showing desired take-off connections. We'll prepare a manifold proposal—No obligation.

ALMO TOOL COMPANY
11470 Kaltz—Centerline, Mich.

"Design Wise"

Colonial Broach Co. uses an Almo manifold in this 15 ton capacity, 66" stroke dual-ram broaching machine.

CIRCLE 8 ON READER SERVICE CARD

CIRCLE 31 ON READER SERVICE CARD

PROVED

and IMPROVED MINIATURES for AUTOMATION!

Clippard
MAC-38S
Spring Return, Single Acting Air Cylinder

MAC-38D
Double Ram, Double Acting Air Cylinder

MAC-38S
Single Ram, Double Acting Air Cylinder

MAN-12
12-Port Manifold

MAV-2 & 3
2 and 3-Way Air Valves

For automatic work and control applications on present machines, tools, jigs and fixtures, or new equipment you are now designing, you will find Clippard Miniature Air Cylinders, Valves and Accessories unequalled for many tasks.

Carefully designed and constantly improved, they furnish precision power where savings of space or weight are a MUST. They mount quickly and easily and will give you millions of cycles of trouble-free operation.

Put these quality midgets to work for you, NOW, to increase production and improve work quality. Write for interesting data-filled catalog and modest prices.

Clippard INSTRUMENT LABORATORY, INC.

7396-H Colerain Rd., Cincinnati 39, Ohio • Phone: JAckson 1-4261

Manufacturers of R. F. Coils, Electronic Equipment, Miniature Pneumatic Devices

Now . . . for the first time—

A FLUID POWER TRAINING PROGRAM
to fill industry's need for trained personnel

Hitchcock's NEW "job-related" home study course "INSTALLATION, OPERATION and MAINTENANCE of FLUID POWER EQUIPMENT

An up-to-date practical course of study covering Theory, Fundamentals of operation, Application, Diagnosis and Repair for all types of hydraulic and pneumatic equipment and controls.

The problem of developing properly trained, qualified personnel to install, operate and maintain FLUID POWER EQUIPMENT becomes greater day by day. Design simplification and "advanced mechanization" continually expands and increases the uses of FLUID POWER to increase production and operating efficiency in all phases of industry.

Hitchcock Publishing collaborated with two of the nation's leading fluid power authorities to develop this program. Now, men can be trained "on-the-job" through home-study and daily direction in the development of practical skills in fluid power.

Hitchcock's course is available to company sponsored group enrollments or individuals on a low-cost basis in a convenient, practical 18 chapter study course. Upon completion of the course, students will attend a 2 day work-shop session for practical review, application and discussion of the material covered.

Investigate **the advantages of Hitchcock's FLUID POWER home-study course for training individuals to fill your fluid power personnel needs. You'll benefit through increased production and operating efficiency. Send for complete information and enrollment forms today !**

HITCHCOCK Publishing Company / Dept. of Training & Education, Industrial Services Division, 222 E. WILLOW AVE., WHEATON, ILLINOIS

HYDRAULIC SEQUENCING

Concluded from page 108

spring-loaded position, locking the HOLD valve in position.

At the top of the stroke, the STOP valve is actuated mechanically. This drains the right end-chamber of the HOLD valve and the spool is again centered by the springs. The MAIN valve also shifts to center position unloading the main pump and holding the ram up.

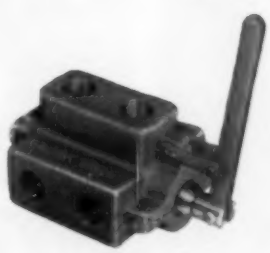
• **Operating Speed**—The approximate time required to shift the valves can be calculated using the displacement of the valve spools and delivery of the pump. The piping betweeen the pump and valves is ⅜ inch and is not more than 4-ft. long, so that its resistance to flow is negligible. The START and REVERSING valves open to almost full line size and offer little resistance to flow. The HOLD valve has a 1-inch diameter spool which shifts ¼ inch, so the displacement is .2 cu. in. The MAIN valve has a 1-inch diameter spool and shifts ¾ inch. If the pilot pump delivers 2 gpm (554 cu. in./min.), the HOLD valve will require .0217 sec. to shift. The total time for shifting both valves is .0867 sec. This speed is usually fast enough, but it can be increased by fitting a small accumulator in the pilot system. This would also permit using a smaller pilot pump. ▼▼▼

DOUBLE SELECTOR VALVE

GRESEN HYDRAULICS

A NEW GRESEN PRODUCT NOW AVAILABLE

Model DS-75



FEATURES: Cast iron body—pressure balanced spool—Easy to mount—Chrome plated spool—Optional three handle positions.

SPECIFICATIONS: Capacity—24GPM @15 ft/sec.
Pressure range—0 to 1500 PSI
All openings—¾" NPT
Shipping weight—12 lbs.

Write for literature

GRESEN MANUFACTURING CO.

405-35 Ave. N. E. Dept. AH-38 Minneapolis 18, Minn.

CIRCLE 61 ON READER SERVICE CARD

CIRCLE 55 ON READER SERVICE CARD

ADAMS PORO-STONE AIR FILTER

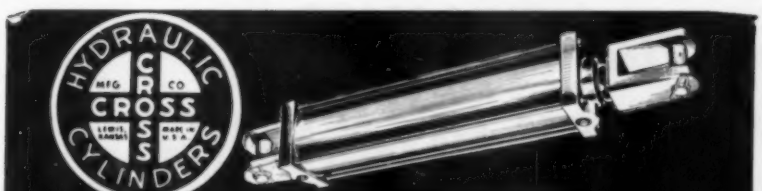
designed to remove oil, water and foreign matter from compressed air lines with minimum pressure drop.

The R. P. Adams Poro-Stone air filter is engineered to efficiently remove entrained oil, water and pipe scale from compressed air lines. Liquid droplets and solids being carried by the gas stream are first removed by centrifugal action in an annular chamber. Secondary filtration is achieved by passing the air or gas stream through a Poro-stone unit. An automatic trap can be provided to discharge the residue from the cyclone chamber.

At rated capacity the filters operate at a maximum pressure drop of only ½ lb., thus insuring delivery of line pressure to the point of consumption.

The units require virtually no service or maintenance — thereby insuring continued trouble-free, low cost performance.

ADAMS Poro-Stone air filters are available from stock in sizes to suit your needs. For further information, write today for Bulletin 117, R. P. Adams Co., Inc., 249 East Park Drive, Buffalo 17, New York.



RUGGED ECONOMICAL DEPENDABLE

THE MOST REASONABLY PRICED ENGINEERED QUALITY CYLINDERS AVAILABLE

CROSS MANUFACTURING CO.
LEWIS, KANSAS ■ PHONE EA 4-5525
WRITE • WIRE • PHONE

KEEP HYDRAULIC OILS FIT for Long Service with

Magnetic Separators

Hydraulic oils need maintenance too! Only clean oil is good oil—and Frantz FERROFILTERS keep it clean.

These magnetic separators remove particles of rust, scale, core sand, iron and steel worn off moving parts and other ferrous particles, making the oil fit for continued service . . . and also helping prevent sticking of valves and wear of pumps.

Standard FERROFILTERS may be installed on the intake side of the pump. For the high pressure side we make these units with pressure ratings up to 5000 psi.

LOW PRESSURE FERROFILTERS 1" and under made this way
Other low pressure models to 8" pipe size.
HIGH PRESSURE models to 5000 psi also available

Send for Bulletin FM-65

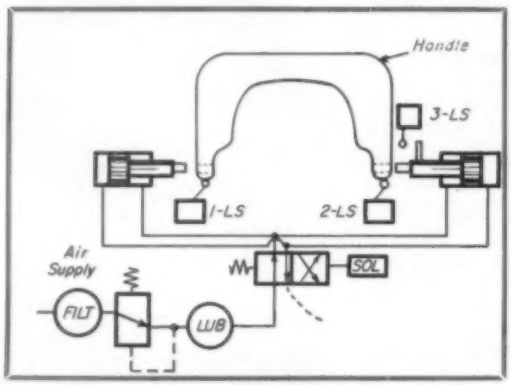
S. G. FRANTZ CO., Inc.
Brunswick Pike and Kline Ave.
P. O. Box 1138 Trenton 6, N. J.

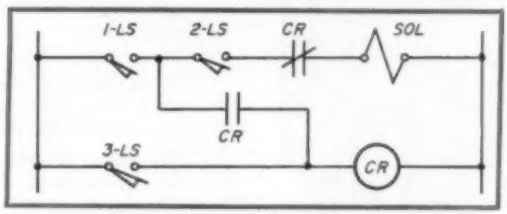
Air gives 100-lb punch

• By M. G. Saake, *Ribble Engineering Co., Hackensack, N. J.*

STEP back three paces, and you couldn't tell it from leather. Plastics has made tremendous inroads in the luggage industry. It's tough and it's cheap. One reason for this is low cost, high speed production methods.

At United Plastic Products Corp., Long Island City, New York they've developed an air-actuated machine to punch holes in plastic brief case handles. Just as fast as a girl can put blank handles into the machine, two holes are punched at once.

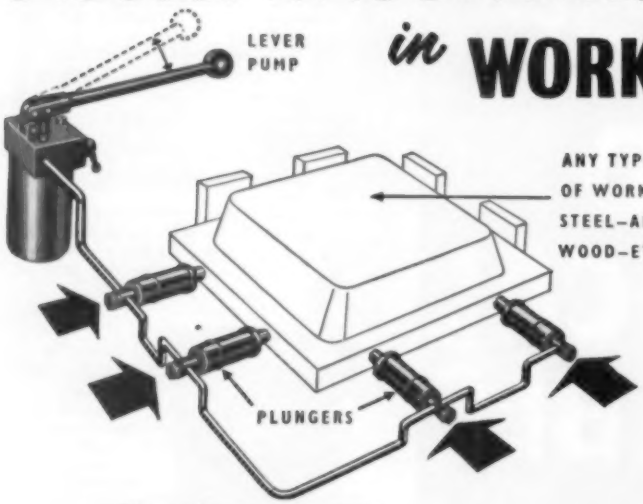




RELAY DE-ENERGIZES SOLENOID at completion of cylinder work stroke and remains actuated until work is removed.

BOTH LIMIT SWITCHES 1-LS and 2-LS must be actuated before the cylinders can extend. This is a safety feature to insure that the work piece is fully inserted.

BIGGEST TIME & MONEY SAVER in WORK CLAMPING



NEWTON TRADE PRODUCT MARK Hydraulic CLAMP SYSTEM

These plungers can exert a pressure of from 800lbs—4 tons.
Can be used in groups of any number.

Maximum pressure with smallest plungers
Easily adaptable to any fixture design
Simultaneous plunger action
Minimum floor to floor time.

POWER JACKS LIMITED
MAYLANDS AVENUE · HEMEL HEMPSTEAD
ENGLAND · GRAMS: NEWSORDER, HEMEL HEMPSTEAD

Send today for illustrated brochure F/243

CIRCLE 102 ON READER SERVICE CARD

Two air cylinders deliver the double punch for this operation. Each has a 2-inch bore and a 2-inch stroke and delivers a 100-lb thrust. The dies are designed so that the material is cleanly removed as two cylindrical slugs.

• **Electrical Control**—Three limit switches interlock the cylinder actions. Limit switches 1-LS and 2-LS (normally open) are closed when the handle is inserted. When both of these switches are closed they energize the solenoid valve which shifts to apply pressure air to the blank ends of the cylinders.

When the cylinders complete their punch, limit switch 3-LS is actuated. This energizes the relay. Normally closed contacts of the relay, in series with the solenoid, de-energize the solenoid. The valve shifts to its spring-loaded position returning the cylinders to their retracted positions. The normally open relay contact holds in the relay after limit switch 3-LS is deactuated. This holding circuit is disconnected when the operator removes the work piece deactuating limit switch 1-LS.

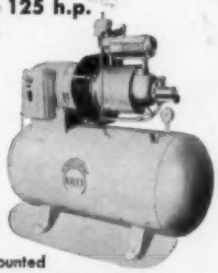
By using a generous 2-inch stroke to punch the holes which are approximately ½-inch long, the cylinders do not have to be synchronized. If depth were critical, and one cylinder completed its stroke before the other, 3-LS would be installed with the slower acting cylinder. This assumes that these characteristics would remain for the life of the machine. ▼▼▼

HYDROVANE DAVEY

NEW... meets every industrial need!

Stationary units . . . 20 to 125 h.p. @ 125 p.s.i.

- ✓ Silent . . . vibrationless . . . compact
- ✓ Complete line . . . 2 to 125 h.p. . . . 8 to 500 c.f.m. @ 125 p.s.i.
- ✓ No complicated engineering . . . no compressor room . . . no foundation
- ✓ Easy to install and operate
- ✓ Air cooled or water cooled



Write for Bulletin M-132

Tank mounted 2 to 5 h.p. @ 100-200 p.s.i.

INDUSTRIAL DIVISION

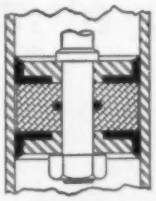
DAVEY pioneers of "air-cooled air"

DAVEY COMPRESSOR CO.

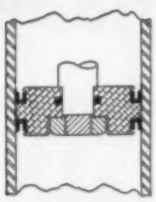
Kent, Ohio

CIRCLE 38 ON READER SERVICE CARD

Redesign with PALMETTO® U-RING for low cost and low friction



BEFORE . . . *double acting piston assembly with standard molded cup packings.*



AFTER . . . *same application using PALMETTO U-Ring.*

Engineers designing hydraulic and pneumatic cylinders are finding that PALMETTO U-Rings permit the use of low-cost, one-piece pistons in place of expensive, multi-part designs, with no sacrifice of efficiency. In fact, the one-piece piston with PALMETTO U-Rings is superior because it cannot loosen up, is easily assembled and serviced, and saves weight and space.

PALMETTO U-Rings seal with extremely low friction because they float freely in the packing groove. There is no opportunity for binding due to overcompression. Synthetic and fabric reinforced compositions in similar sizes allow interchangeability for high or low pressure service. The PALMETTO U-Ring is doing an exceptional job in the hydraulic equipment of many well-known manufacturers. Ask us how it can be used in your piston design to cut costs.

Rugged rectangular design PALMETTO U-Rings increases stability and eliminates rolling in the groove. Wide-lipped flare makes it suitable for use in cylinders made from commercial tubing honed up to .030 over nominal sizes.

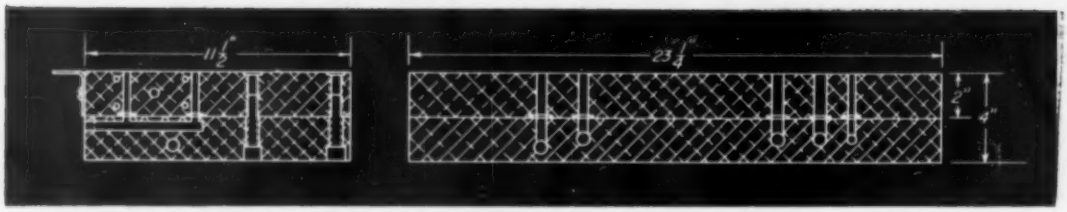
For information on other PALMETTO packings and how they can help you simplify your design, please write.

packing more performance into every application — PALMETTO Packings

GREENE, TWEED & CO.

NORTH WALES, PENNSYLVANIA

CIRCLE 53 ON READER SERVICE CARD



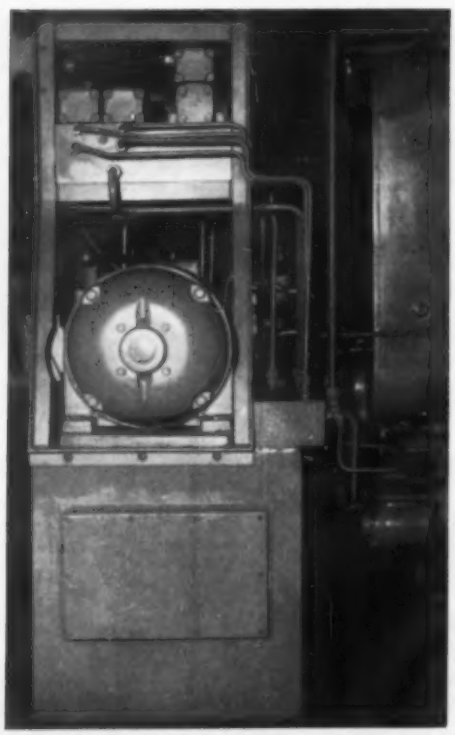
1000-psi valve manifold uses bolted aluminum plates

SIMPLICITY and low cost are the result of using bolted construction for a valve manifold.

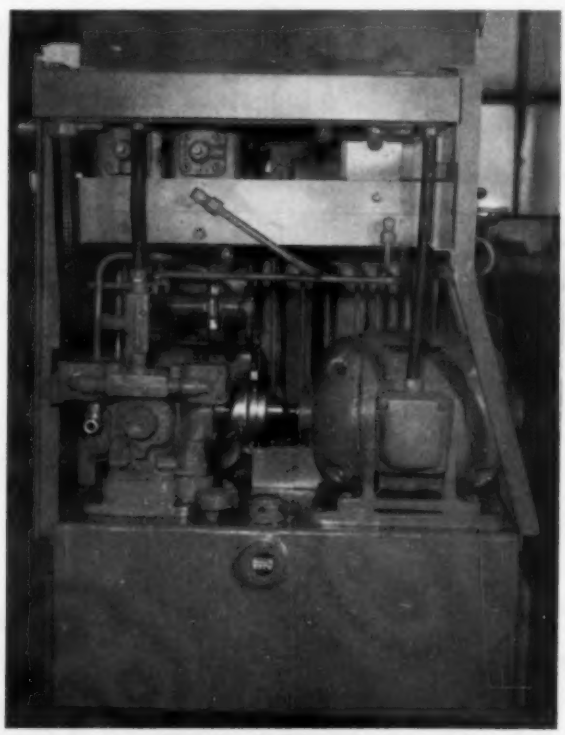
When designing the hydraulic power and control circuit on the Barber-Colman 14-15 gear hobbing machine, several manifold types were considered. Evaluating cost, materials and manufacturing technique led to selection of rolled aluminum plates. Two plates measuring 2"x11½"x23¼" are fastened together after machining by eight socket-head, ½-13 cap screws. O-ring seals, located in drilled passages between the plates, prevent leakage at the joined surfaces.

Rolled aluminum is dense. There's no possibility of leakage caused by porosity of the plates. Plates are surface ground to insure flatness before assembly.

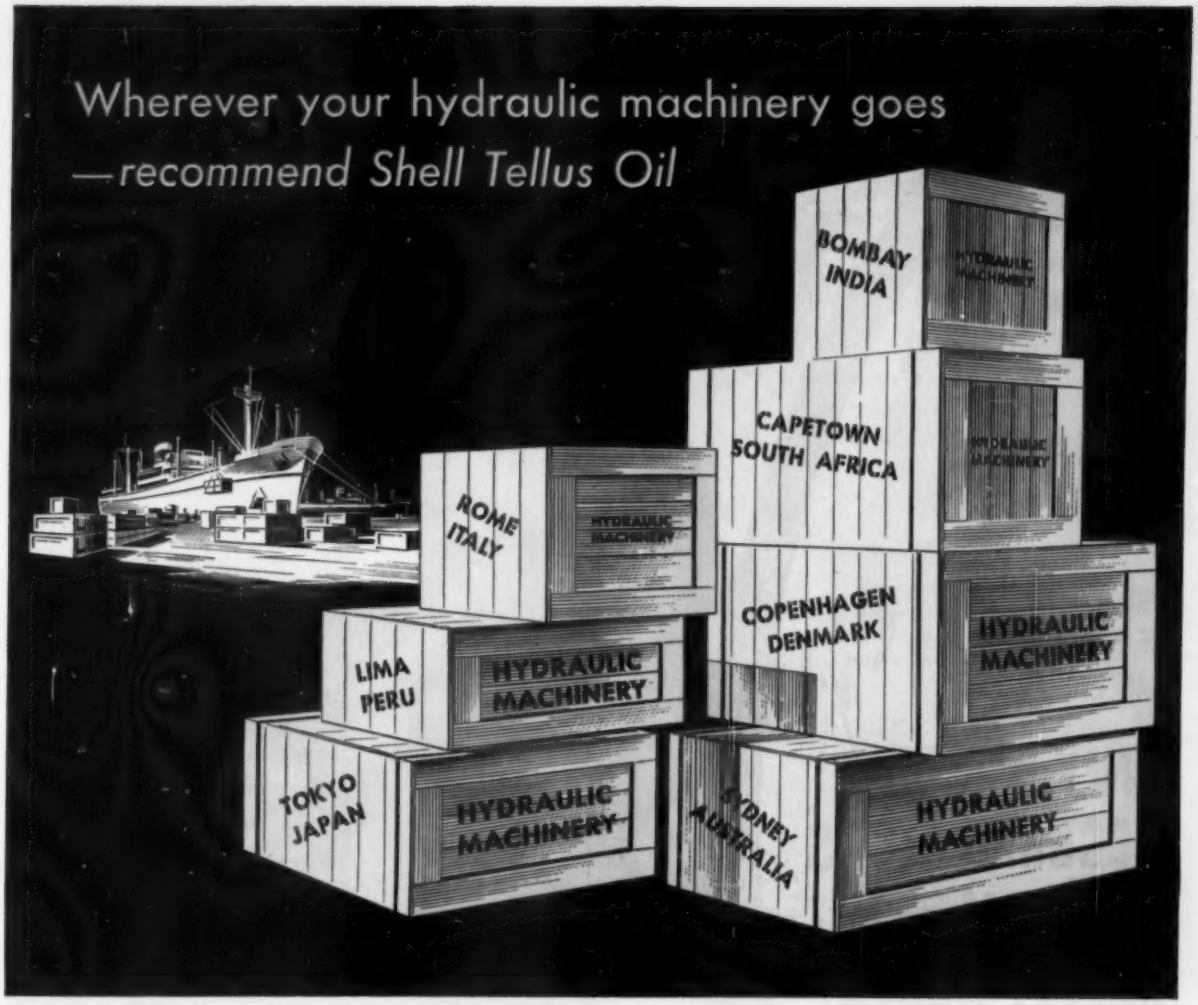
Valves control several feed cylinders and a rotary fluid motor. Pump unit is a variable volume, radial piston pump with an integral fixed displacement gear pump. Pressure from the variable pump is 750 psi during feed; 1000 psi during rapid traverse. The gear pump generates 300 psi. ▼▼▼



POWER PACKAGE for a Barber-Colman gear hobber includes six gasket-mounted valves on a manifold above pump and electric drive motor.



ELECTRICAL wiring for the solenoid valves and motor is tied into a junction box mounted near the top left side of the framework.



Its performance and name are the same around the world

Other Outstanding Shell Industrial Lubricants

Shell Rimula Oils—for heavy-duty diesel engines

Shell Talona R Oil 40—anti-wear crankcase oil for diesel locomotives

Shell Alvania Grease—multi-purpose industrial grease

Shell Turbo Oils—for utility, industrial and marine turbines

Shell Dromus Oils—soluble cutting oils for high-production metal working

Shell Macoma Oils—for extreme pressure industrial gear lubrication

Shell Voluta Oils—for high-speed quenching with maximum stability

Shell Tellus Oil is top-rated as both a lubricant and a control fluid for complex hydraulic systems. Its ability to combat oxidation, rust, sludge-formation, wear and foaming has earned it nationwide popularity.

You may be glad to know that the hydraulic-operated equipment you manufacture can now obtain the same efficient protection in other countries of the world. Tellus* Oil is available to your customers abroad. With it they can enjoy the same performance that your domestic customers rely upon.

For more complete information on Tellus Oil, write Shell Oil Company, 50 West 50th Street, New York 20, New York, or 100 Bush Street, San Francisco 6, California.

*Registered Trademark

SHELL TELLUS OIL

SHELL

PROOF
OF EXTRA
SAFETY...

ONLY GREER ACCUMULATORS MEET ALL SAFETY CODES!

Qualify for any type hydraulic installation under all safety ordinances everywhere because . . . they're

BURST-PROOF!

Design engineers using hydraulic accumulators on machines and equipment in interstate commerce must be aware of stringent nation-wide safety regulations. For guaranteed acceptance everywhere, specify the Greer Accumulator — the only accumulator that meets all safety codes. More than 81,000 Greer Accumulators are now in use in every state of the union and in almost every industry. These exclusive built in safety features tell you why:

AIR VALVE Absolutely leak-proof for pressures up to 12,000 psi. Integrally molded one-piece valve stem prevents air loss.

SHELL No seams. No welds. No joints. Made of single-piece homogenous chrome molybdenum steel. 18% elongation in two inches guarantees against metal fatigue. 5 to 1 safety margin above maximum working pressure of the accumulator.

MOUTH Designed to yield at 400% of maximum working pressure. This safety feature releases pressure if relief valve clogs or sticks, or if system is blocked.

PLUG ASSEMBLY Accumulator cannot be disassembled until complete gas charge in bag has been released. Lack of this safety feature has caused serious accidents. Be sure to check this protection.

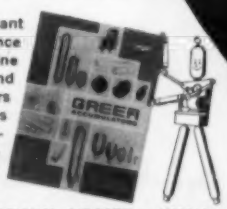
Greer Accumulators meet all J.I.C. and I.C.C. safety standards including the strict Penn. Boiler code, and conform with all municipal, state and insurance underwriters safety codes in accordance with ASME specifications on unfired pressure vessels.

Learn more about Greer Accumulators and how they can cut costs on your hydraulic equipment. Contact the franchised Greer distributor in Buffalo, Cleveland, Houston, Philadelphia and Pittsburgh. Inquiries invited from distributors in other areas.

U. S. PATENTS
UNDER
GLAER LICENSES

WRITE OR PHONE FOR GREER BULLETIN PR-200

An important catalog reference on the complete line of Greer standard and special accumulators with circuit diagrams and applications. Also details on hydraulic components made by Greer such as valves, filters, actuators, etc.



GREER HYDRAULICS INC. • INTERNATIONAL AIRPORT • JAMAICA 30, NEW YORK

Manufacturers of Precision Test Equipment and Hydraulic Components

AVIATION SECTION

Applied Hydraulics

MARCH 1958

LOCKHEED ELECTRA'S HYDRAULIC SYSTEM 118

By Harlan Asquith

More hydraulically-operated systems, higher flight speeds and large passenger capacity make reliability a must. Fast servicing increases aircraft operating time. The Electra hydraulic system is designed to be safe and easily serviced.

CAM-ACTUATED SERVO VALVES CONTROL WIND TUNNEL AREA 120

By John McComber

Modified machine-tool tracer valves control fluid motors to reliably vary air velocity in a wind tunnel. Required accuracy is gotten at reasonable cost.

AVIATION NEWS FROM THE FLUID POWER FIELD 124

AVIATION COMPONENT DATA 126

EDITORIAL ADVISORY BOARD

WAYNE S. BOALS Hughes Aircraft Co. • **HAROLD E. WELLS** Bendix Aviation Corp. • **H. G. CONWAY** Short Bros & Harland, Ltd. • **RALPH E. MIDDLETON** Lockheed Aircraft Corp. • **HOWARD FIELD, JR.** Convair, A Division of General Dynamics Corp. • **W. F. TALBOT** Northrop Aircraft, Inc. • **ALBERT WEISSKOPF** Grumman Aircraft Engineering Corp. • **KENNETH W. DUBOIS** Douglas Aircraft Co.

BRAKE VALVES

By
M.C. MFG. CO.

a leader in the development and manufacture of dependable, lightweight, hydraulic, pneumatic and fuel components

The picture above shows the
MC 4351
VALVE AND COMPENSATOR—
PARKING BRAKE
For Aircraft Brake Systems

Characteristics

TYPE: Controllable Check with 2-Stage, Spring Loaded Compensator
FLUID: Hydraulic per MIL-O-5606
TEMP. RANGE: −65°F to +160°F
COMPENSATOR—FIRST STAGE:
Begins Charging at 230 ± 20 PSI
Fully Charged at 500 ± 20 PSI
Capacity .50 in.³
COMPENSATOR—SECOND STAGE:
Begins Charging at 650 ± 25 PSI
Fully Charged at 1100 ± 100 PSI
Capacity .50 in.³
INTERNAL LEAKAGE: None
WEIGHT: 3.4 Lbs.

Other Precision Products

VALVES OF ALL TYPES: Brake • Control • Manual • Pressure Reducing • Relief • Restrictor • Shuttle • Solenoid • Special • Transfer
ALSO: Air Compressors • Dehydrators • Fuel Pumps

M. C. MANUFACTURING CO.
Mail: P.O. Box 126
Plant: 118 Indianwood Road
LAKE ORION, MICHIGAN
WEST COAST OFFICE
716 Wilshire Blvd., Santa Monica, Calif.
Representatives:
D. & O. ENGINEERING CO.
P.O. Box 3107, Wichita, Kansas
F. C. MINCH
1132 Donson Drive, Dayton 10, Ohio

Lockheed Electra's hydraulic designed for safety,

• By Harlan Asquith, *Hydraulic Design Group Engineer, Lockheed Aircraft Corp., Burbank, Calif.*

LOCKHEED Aircraft's Electra has a hydraulic system that does more jobs than hydraulic systems of most of the transports flying today. Prototype model first flew in December 1957. First delivery to an airline is scheduled for September 1958 with the first service flights scheduled for November.

• **System Functions**—Electra's hydraulic system does too many jobs even to list them. They are shown by Figure 1. Most important job the system does in flight is to work flight control boosters on ailerons, elevators and rudder. Landing gear retraction takes more hydraulic power than any other function.

Most important job on the ground is operating the brakes to stop the airplane when landing. Almost equally important is ground steering. Hydraulic power boosted steering lets the pilot make cross-wind landings or take-offs and maneuver easily.

• **Design for Reliability**—First step toward reliability is the removal of the pumps from the vibration and heat of the engines. Electra is the first commercial transport to use all-electric pump drives. This way, loss of an engine does not also mean loss of a pump or pumps as each pump has three generator reliability. Each pump may be switched on or off by a switch at the flight engineer's control panel. Electric pump drives also eliminate 250 feet of tubing which would been necessary to connect the pumps in the engine nacelles to the system.

Three main pumps with capacity of 8 gpm at 2250 psi and 6 gpm at 2950 psi are used. Two of these pumps are in the Number One system, which supplies oil for all hydraulic functions. The other pump is in the Number Two system, which duplicates the Number One system valving and actuators for wing flaps and flight controls. These two systems are completely separate. There are no crossover valves or other hydraulic connections between them.

Sintered stainless steel mesh filters in suction and pressure lines of the pumps are expected to increase reliability by reducing the amount of contamination in the system. Test shows that these filters more consistently maintain their ten-micron rating. Previously used ten-micron filters frequently passed particles of 100-micron size.

An accumulator, isolated from the Number One System by a check valve, stores enough oil to work the wheel brakes about ten times for an emergency or when the main pumps are not running. A small dc motor-driven pump keeps this accumulator charged for towing. Power for emergency braking may also be supplied by an air bottle charged to 3000 psi and controlled by a valve from the cockpit. The bottle is tied to the brake system at the wheels by shuttle valves mounted on the brakes.

All high-pressure lines are stainless steel. Special precautions have been taken to shield lines near oxygen, electrical equipment and bleed air ducts to prevent fire in case of fluid leaks.

• **Serviceability**—Reservoirs, pumps, aileron boosters, wing flap drive, brake accumulator, emergency brake air valve, relief valves and many of the selector valves are all placed in a service center. All these components are easily reached through a large door. Located under the cabin floor and directly behind the rear

system fast service

wing spar, this area is easily reached from the ground making maintenance easy.

Placing so many of the hydraulic components at one place, beside simplifying service, eliminates many tubing connections. Each one gone is one less possible leak.

• **Testing**—Perhaps as important as the design features to safety and easy servicing are adequate tests. All components are tested before installation. They must meet or exceed military requirements. In addition, a complete mockup, using actual components and duplicating the arrangement in the airplane, was built and operated. Each function was tested individually, and then various combinations of units were tested for interaction. Pressure surges and operating temperatures were measured during tests. Critical parts of the system were run at both high and low temperatures. Finally, landing gear extension and retraction were checked by working them 20,000 times.

The mockup tests do not complete the testing, however. It will continue throughout flight testing to assure that the system is completely wrung out before any airplanes are delivered to the customers. ▼▼▼

FIRST FLIGHT PHOTO of the Lockheed Electra. This is the first U. S. produced prop-jet. Power plants are four Allison 501 turbine-propellor engines developing a total of 15,000 hp.

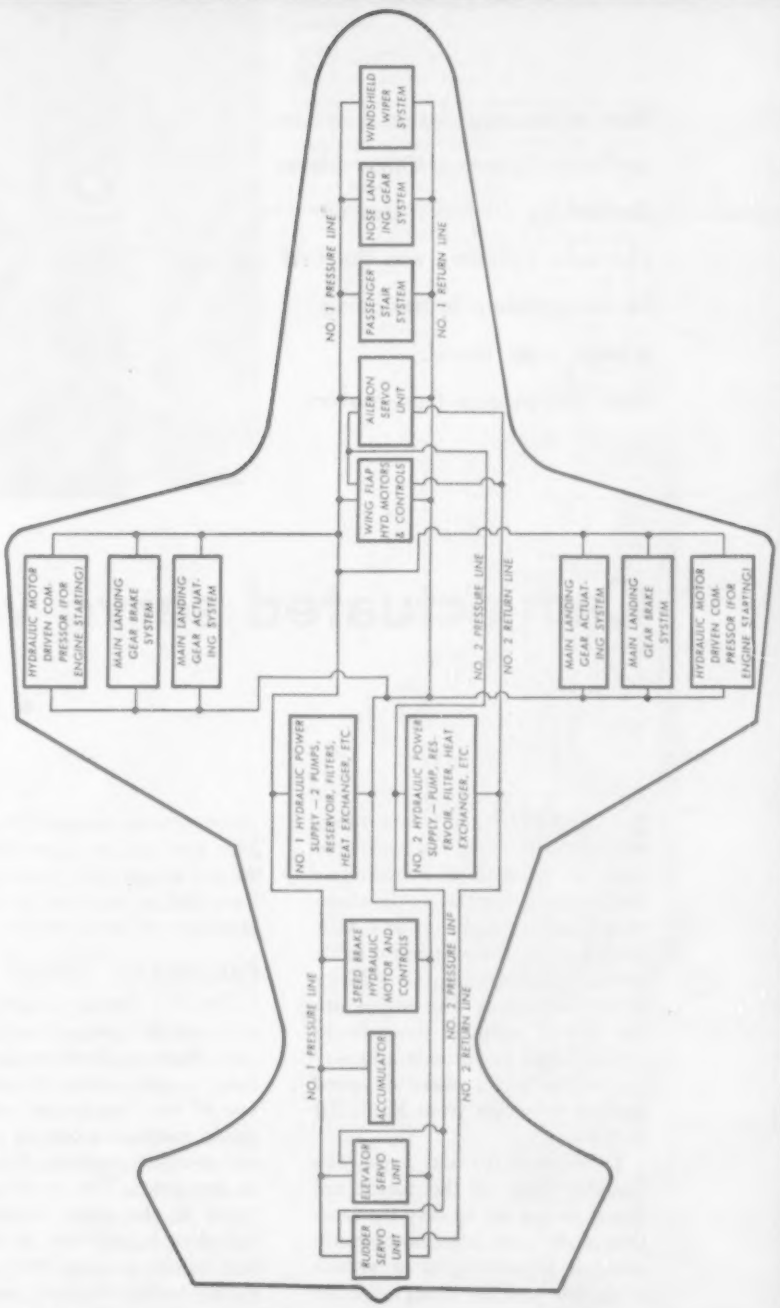
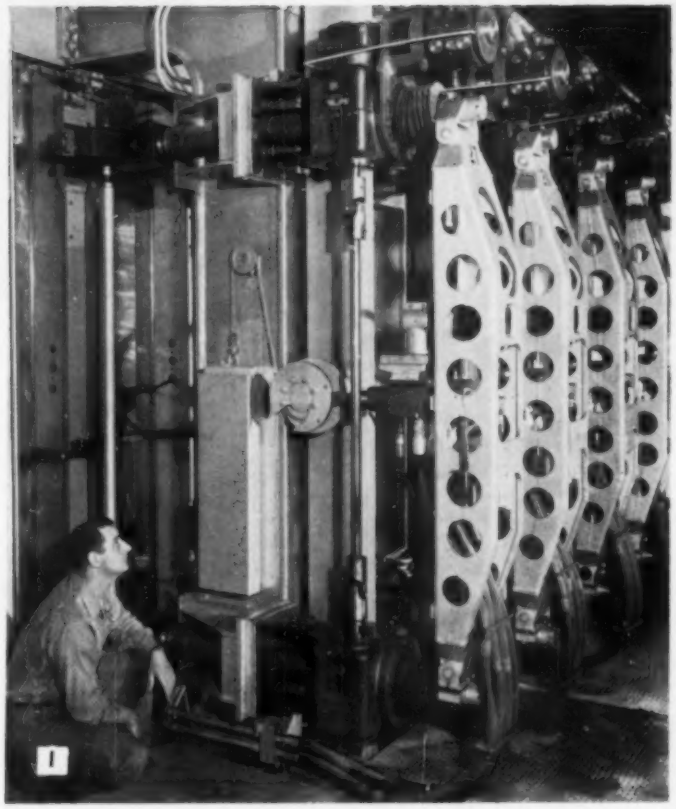

WINDSHIELD WIPER SYSTEM
NOSE LAND ING. GEAR SYSTEM
PASSENGER STAIR SYSTEM
AILERON SERVO UNIT
WING FLAP HYD. MOTORS & CONTROLS
NO. 1 PRESSURE LINE
NO. 1 RETURN LINE
HYDRAULIC MOTOR DRIVEN COM-PRESSOR (FOR ENGINE STARTING)
MAIN LANDING GEAR BRAKE SYSTEM
MAIN LANDING GEAR ACTUAT-ING SYSTEM
NO. 2 PRESSURE LINE
NO. 2 RETURN LINE
NO. 1 HYDRAULIC POWER SUPPLY — 2 PUMPS, RESERVOIR, FILTERS, HEAT EXCHANGER, ETC.
NO. 2 HYDRAULIC POWER SUPPLY — PUMP, RES-ERVOIR, FILTER, HEAT EXCHANGER, ETC.
SPEED BRAKE HYDRAULIC MOTOR AND CONTROLS
ACCUMULATOR
ELEVATOR SERVO UNIT
RUDDER SERVO UNIT

FIG. 1. BLOCK DIAGRAM shows operations done hydraulically on the Electra.

How would you design a system to flex 1 3/8-inch stainless plates 76 feet by 10 feet? Use of hydraulic cylinders was the first approach to this problem in designing a huge wind tunnel. Final design uses fluid motors.



Cam-actuated servo valves control wind

• By John McComber, *Design Engineer, NACA Lewis Flight Propulsion Laboratory, Cleveland, Ohio.*

BY ADAPTING a tracer valve, ordinarily used on machine tools to position a cylinder or fluid motor according to the shape of a template, engineers at NACA developed an accurate and reliable system for controlling air velocity in a wind tunnel. The engine under test is mounted downstream of the throat or variable area section of the tunnel where air speed reaches velocities from Mach 2.0 to 3.5.

To control the air speed, the movable walls of the throat are flexed in and out to vary the area. One of the most important considerations in developing a system to do this was the strength of the plates which formed the walls. This was not known in the early design stages, and extra precautions had to be taken to prevent breakage of the expensive plates.

PRELIMINARY DESIGN

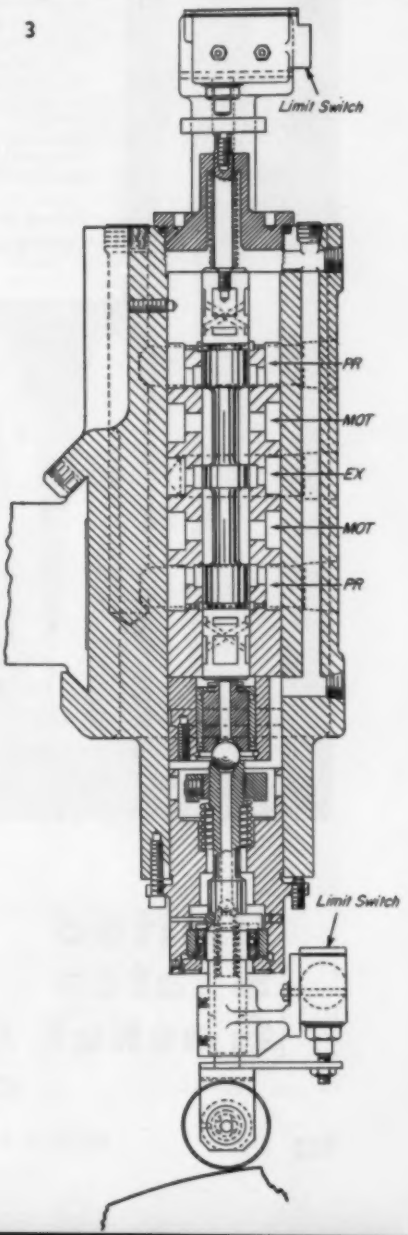
The first design included cylinders mounted perpendicular to the wall. Several disadvantages were noted in this system. Breakage of one of the lines to the cylinders would result in a loss of pressure and a sudden release of the plate at one point. This could mean a break in the plate. Holding the cylinders in position at one setting of the wall for long periods during testing required some type of mechanical lock. Double rod end cylinders were arranged with a screw actuated by a handwheel to bear against the rear piston rod. However this ruled out automatic operation. The objective was to be able to select a position (in terms of Mach No.) from the control room, push a button, and have the plates move to that position without any requirement for an attendent to operate handwheels.

Another difficulty of the cylinder system was synchronization. Two cylinders were to be mounted at each station and operated by two servo valves actuated by the same cam. Slight differences in

1 **WIND TUNNEL THROAT AREA** is controlled by 76-ft. flexing stainless steel plate walls. Fluid motors driving through gear reducers and screw jacks position the walls within .005 in.

2 **COMPACT INSTALLATION** of the pumps has been accomplished by vertical mounting on the reservoirs. Hydraulic system for plate on each side of tunnel is completely separate. Reservoirs are welded together. Main lines for pumps and headers are tubing with welded connections.

3 **SERVO VALVE** which has been modified from a machine tool tracer is sensitive to transverse as well as longitudinal forces. Ball which transmits force from stylus to spool translates all forces longitudinal to the valve axis.



tunnel area

characteristics between the two servo valves could result in different cylinder motions and twisting of the plate. In addition, cost was a deciding factor considering the expensive 6-inch cylinders required and the need for two servo valves at each station.

FLUID MOTOR SYSTEM

In the present design, one or two radial piston fluid motors are controlled by a single servo valve and drive the plate through a gear reducer and screw jack at each one of the 27 stations on each side of the throat. The servo valves are mounted on frames which move with the plate. Cams at each station are driven together and provide the input position to the servo valve. As the plate and valve move to the required position, the valve is shifted to its neutral, closed center position to stop the motors. The cams are step-cut for 16 positions of the plate and have dwell or constant radius arcs for each position. This reduces the required accuracy in relative positioning of the cams.

Force requirements vary along the throat and depend on the internal air pressure as well as flexibility of the plate. Internal static pressure varies from 2 atmospheres at the upstream section of the throat to 0.1 atmosphere at

ITS *flexibility* CUTS COSTS

Use Chemiseal® Nylon Pressure Tubing at a profit. You will find that its low cost—plus the flexible couplings, intermediate fittings and labor it saves—makes the installation a fraction of the cost of metal tubing.

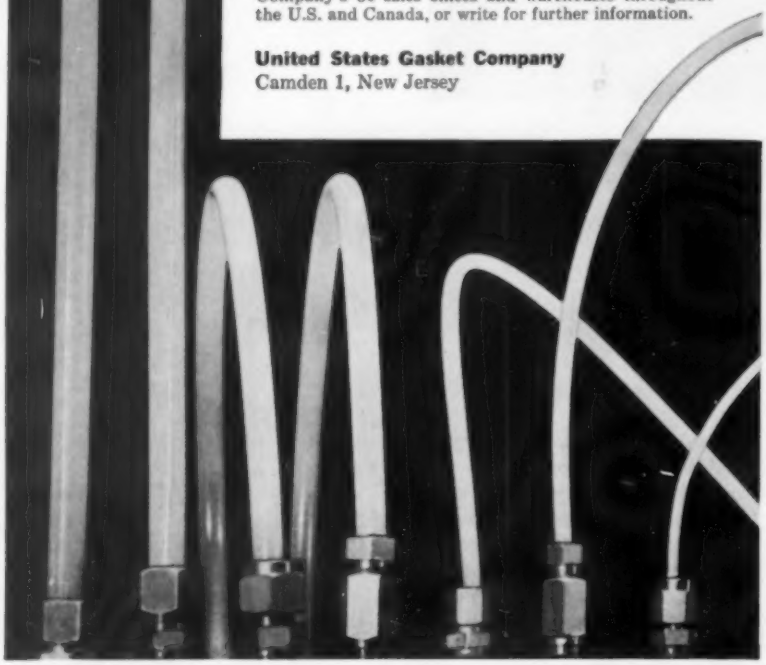
Outperforms Metal

Chemiseal Nylon Pressure Tubing has exceptionally high resistance to flex and vibrational fatigue. It resists abrasion and impact. Is unaffected by oils, hydraulic fluids, alkalies and most solvents. Has service temperature range from −100°F to +225°F. Provides high pressure rating at low cost. Requires no prebending. Utilizes standard metallic flare and compression fittings. Can be installed and fastened around existing equipment.

Made in two grades for 1000 psi and for 2500 psi which conform to J.I.C. specifications for low and medium pressures.

For prompt service, contact one of The Garlock Packing Company's 30 sales offices and warehouses throughout the U.S. and Canada, or write for further information.

United States Gasket Company
Camden 1, New Jersey



United States Gasket *Plastics Division of* **GARLOCK**

CAM-ACTUATED SERVO VALVES

AVIATION

the downstream end. Total operating load per station ranges from 136,000 lb to 70,000 lb. Maximum travel of the jacks ranges from .06 in. at the extreme downstream end to 29.54 in. at the smallest area of the throat.

Two fluid motors are used at the stations with greatest travel because of a speed limitation of 400 rpm on the motors. This limitation was specified to promote long life and minimum maintenance of the motors. The two motors are geared to the input worm shaft of the jack through a 1:2 ratio. If a single motor were used, torque would not be sufficient. Where single motors are installed, they are directly connected to the input worm shaft. Approximately 25 minutes are required to go from one extreme position of the plates to the other.

SAFETY

Previous experience with wind tunnel failures called for the design of several safety features on this installation. Because of the precision clearances in the servo valve, this component is subject to sticking. Since the valve is mounted on a frame that moves with the plate to give a follow-up action, sticking of the valve could cause it to lose contact with the actuating cam, so that the motors would continue to move the plates past the required position. This is possible even though a spring is installed in the valve to force it against the cam.

To guard against this, the roller contact of the valve is spring-loaded, and a limit switch is mounted on the valve to sense whenever the roller loses contact with the cam. The limit switch is normally actuated. De-actuation of the switch shuts down the system.

A second limit switch is mounted to sense over-actuation of the valve spool. This is located at the end of the valve opposite the roller and shuts down the system when the plate lags too far behind the position called for by the cam.

In addition to these, limit switches are mounted in a parallelogram arrangement of linkages at each station to sense excessive curvature. The plates are designed for a maximum bending stress of 40,000 psi.

The two screw jacks at each station are connected together through universal joints. Breakage of these joints could cause a twisting of the plate. To prevent this, limit switches are mounted on the frame to sense any twisting of the frame.

The fluid motors are supplied by five 92-gpm, axial piston pumps each driven by a 50-hp electric motor. A single relief valve is set at 600 psi. Filters are connected in the lines to each fluid motor installation.

A separate double pump is provided for cooling and filtering. The 58-gpm section of this pump delivers to three shell-and-tube exchangers connected in parallel. These heat exchangers were installed to satisfy an original requirement that the system be able to run at least one hour without overheating. They are supplied with cooling water only when the system will be in use over an extended period of time for set-up purposes or adjustment of valve positions.

The 5-gpm section of the double pump supplies two filters connected in parallel and containing Fuller's Earth elements. A pressure gage marked *Clean* and *Change Filter* is installed with the filters. ▼▼▼

NEED CASH?

Find out how you can get part of the $1200 APPLIED HYDRAULICS will award winners of the 1958 Prize Paper contest.

For Rules Booklet

CIRCLE 240 ON READER SERVICE CARD

2nd Printing!

Available July 1st

AIRCRAFT HYDRAULIC DESIGN

by **GEORGE R. KELLER**
Group Leader,
Flight Control Engineering Dept.
Autonetics, A Division of
North American Aviation

First published April 1957, the entire printing was sold out in eight months.

Place your order now to reserve copies of the second printing scheduled for mailing July 1st.

Published by
APPLIED HYDRAULICS Magazine

- **The first book** dealing with hydraulic component and system design for high-speed piloted aircraft and missiles, has been written by a leading aircraft engineer. Developed from practical and theoretical material, the book develops many basic equations including those relating pressure gradient, flow-path dimensions, flow rate, velocity, fluid density, and viscosity.

- **Design of system components** including actuators, valves, pumps, accumulators, transmission lines and seals is discussed. Accumulator theory is presented with a detailed example of proper accumulator selection.

- **Hydraulic servo systems** are diagrammed and the transfer functions developed. Fundamentals of transient analysis technique and frequency response method of servo testing are given. The chapter on high temperature hydraulics outlines present progress in fluids, seals, springs, metals, and other critical components, and indicates future developments and techniques.

The advance of industrial hydraulics in servo components and systems makes this book of great value to designers of industrial equipment as well as aircraft engineers.

$4.50

10 or more $4.00 per copy

The Industrial Publishing Corporation
812 Huron Road • Cleveland 15, Ohio

Please send me ——— copies of AIRCRAFT HYDRAULIC DESIGN

☐ Bill me (order no. ———) ☐ Money order attached

NAME .....

ADDRESS ..... CITY ..... STATE .....

AVIATION NEWS

from the fluid power field

Waterford, N. Y.—A new silicone hydraulic fluid has been announced by the Silicone Products Dept., **General Electric Co.** Designated Versilube 81717, the new fluid has a special extreme-pressure additive which makes its lubricity properties far exceed those of previous silcone fluids and the equal of most natural or synthetic lubricants.

Produced under a development contract with Wright Air Development Center, 81717 fluid can withstand prolonged use over the —65 to 575 F range according to announcements by GE and WADC. Under certain conditions it will work for extended periods at 700 F.

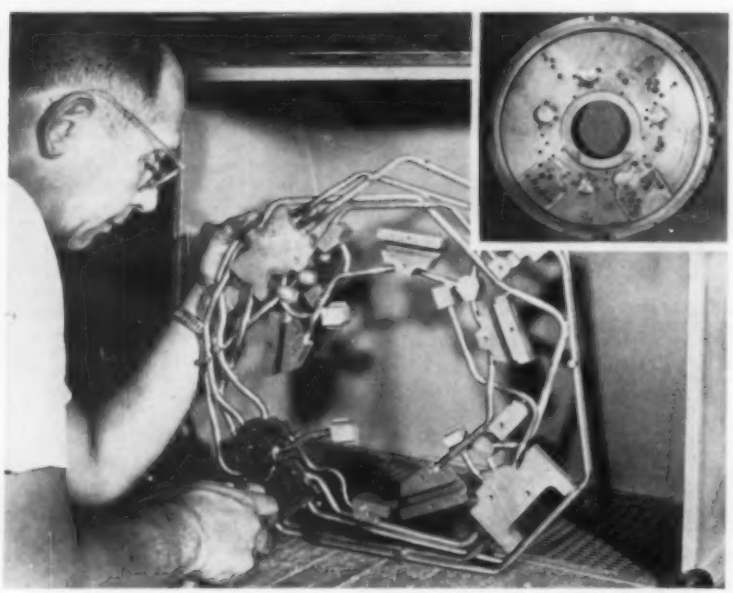
Wladimir A. Reichel has been named senior vice president of **Norden-Ketay Corp.** Previously senior vice president, engineering, of General Precision Equipment Corp.

Minneapolis-Honeywell Regulator Co. has announced that it will begin production within the next few months on a major contract for automatic control systems for missile ground facilities. The **Missile Equipment Division** will be established at Pottstown, Pa.

Vickers Inc. has announced the appointment of **A. L. "Larry" Stone** as Western Regional Sales Manager, Aero Hydraulics Div. He will be responsible for the sale of hydraulic components, packages and subsystems for aircraft and missiles in the far west. His headquarters will be at the Torrance, Calif. plant. Mr. Stone got a B. Sc. degree from the University of Southern California in 1949 and has been with Vickers since 1951.

A. L. Stone
Aero Hydraulics Div.
Vickers Inc.

HYDRAULIC FEATHERING MECHANISM . . .



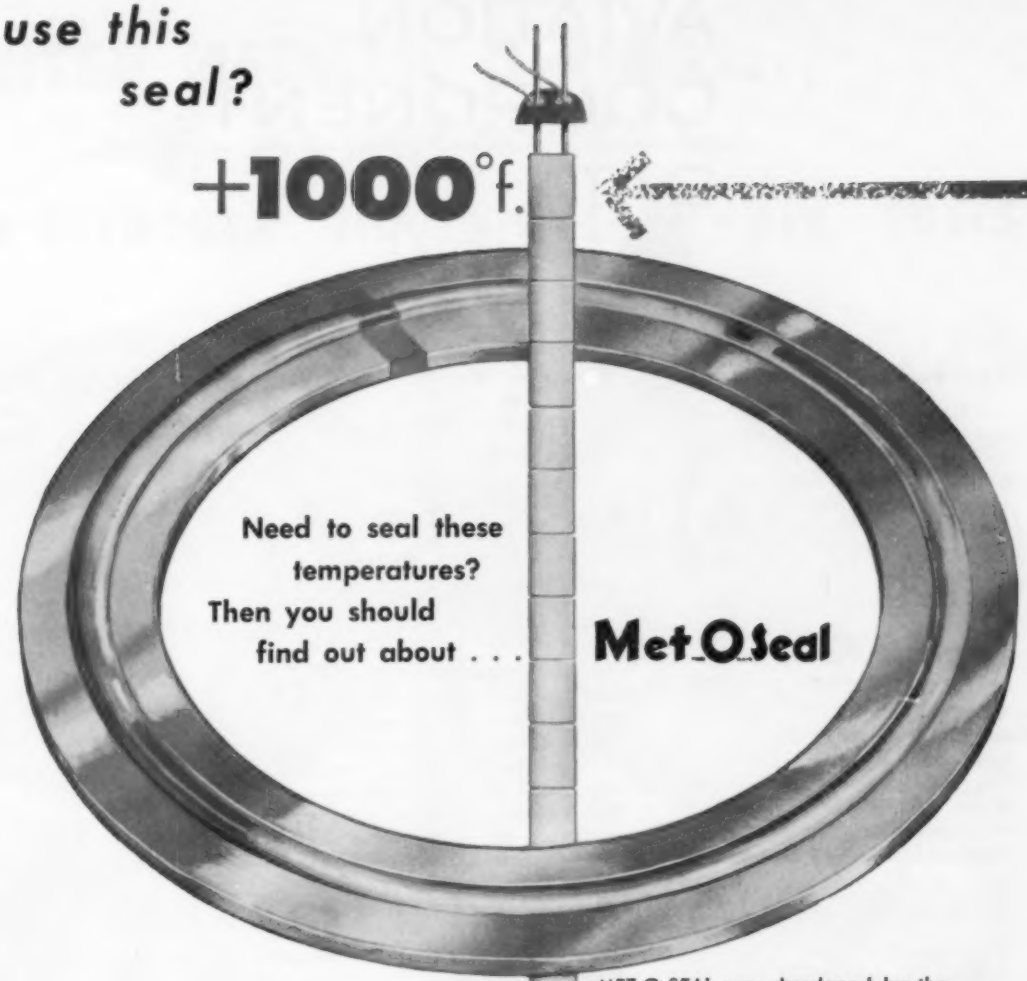
. . . for propellors of the Lockheed Model 606 Electra is complex but must be kept light and leakproof. Weight of the plumbing shown here was reduced 50% by using extruded pads rather than ordinary bar stock. The workman is brazing a piece of tubing to one of the pads made by Allegheny Ludlum Steel Corp. After the system is assembled, it is cast into a single unit as shown in the inset. This unit mounts right behind the propellor hub.

Gut Fur Ein Schmeil, Ve Hope

Recently, we came across a group of strange translations of technical terms into what we think might be called broken German. Credit for these Klaunische Spoofenzies, as they are called, belongs to Bob Reiland of das groenen und schtrainen grupe—translation: engineering structures group—Temco Aircraft Corp. Anyhow, here's the one we thought you might enjoy. Hydraulic Fluid —Das Pullen-Und-Schoven Juce.

can you use this seal?

+1000°f.



Need to seal these temperatures? Then you should find out about . . .

Met-O-Seal

MET-O-SEAL was developed by the Franklin C. Wolfe Company to provide a practical answer to *no-leakage* sealing at extreme temperatures. Here are just some of the advantages obtainable:

- Lower machining costs
- Less flange weight
- Can not blow out
- No loss of structural strength
- No leakage!

If you design in these temperature ranges why not find out about MET-O-SEAL, one of the proven members of the Gask-O-Seal Family?

New literature NOW available upon request. Write For Free Copy.

−400°f.

FRANKLIN C. WOLFE CO.

Culver City, California

"sealing design specialist"

A DIVISION OF Parker Hannifin CORPORATION
creative leader in fluid systems

AVIATION COMPONENT DATA

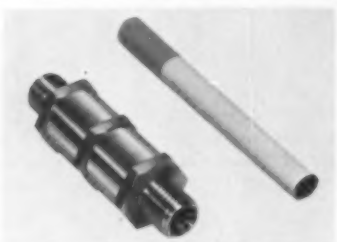
Hydraulic Motors

. . . of the constant-displacement type, intended for airborne applications, are covered by four-page Bulletin A-5205-A. Torque, displacement, pressure ratings, ambient temperature limits and operating speeds are listed.—*Vickers Inc., Detroit, Mich.*

CIRCLE 500 ON READER SERVICE CARD

Restrictor Valves
. . . are small and light

Available in ¼, ⅜ and ½-in. line sizes, these units are small and light. Smallest size is 2-7/16 in. long with a 0.688-in. hex. Weight of the valve is 0.143 lb. All parts are stainless steel. Precision sharp-edged orifices control flow in both

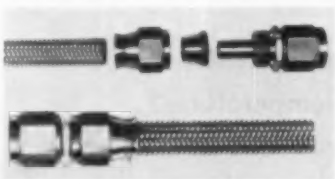


directions. Orifice sizes are as specified by the user from 0.006 in. dia. up. Valves may be used with any liquid or gas compatible with 300 series stainless steels. Orifices are protected by stainless steel mesh filters. Ports are per AND10050, AND10056 or MS33514.—*A. U. Stone & Co., Inc., New York, N. Y.*

CIRCLE 501 ON READER SERVICE CARD

Reusable Fittings
. . . for Teflon hose

Easily assembled without special tools, "SEAL-LOCK" fittings have a triple-locking feature which locks the hose to the fitting and the pieces of the fitting to each other. The fittings cannot loosen from vibration or blow off. Two seals designed into the fitting are pressure-actuated to provide positive sealing. Lefthand assembly threads

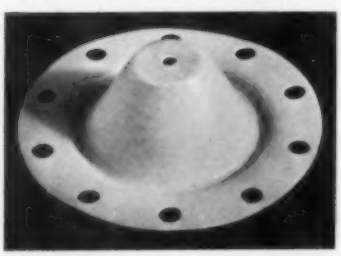


prevent accidental loosening during installation. Flared skirt on the socket prevents high stress concentration. Critical parts are hardened to assure that the fittings may be safely used over and over again. Both straight and elbow types are available in —3 through —20 sizes.—*Resistoflex Corp., Roseland, N. J.*

CIRCLE 502 ON READER SERVICE CARD

Variable-Area Diaphragm
. . . is self compensating

Use of this variable-area diaphragm can eliminate the need for a pressure regulator in many applications. Compact enough to install as a valve-actuating device, it



may be used with many valves with good stability despite operating pressure variations. Design is such that pressure increase reduces effective area and sensitivity.—*Bellofram Corp., Burlington, Mass.*

CIRCLE 503 ON READER SERVICE CARD

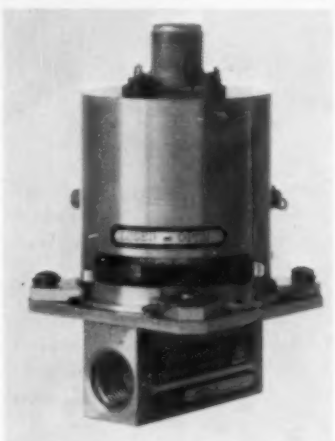
Flow Limiters

. . . for use at temperatures of —65 to 400 F are described in a four-page bulletin available upon request. Complete specifications, engineering data and typical applications are included.—*Conair Inc., Glendale, Calif.*

CIRCLE 504 ON READER SERVICE CARD

Solenoid Ball Valve
. . . for missiles

Two-way, two-position ball valve has flow path equivalent to ¼-in. dia. or ⅜-in. tube size. Solenoid-operated and manually-reset, the valve can be supplied normally-



closed or normally-open. A momentary electrical surge of 2.5 amp actuates the valve. Pressure rating is 4500 psi. Temperature range is —300 to 300 F. Standard solenoid is for 24 v dc operation, other ratings are available. Weight is approximately 0.8 lb, unpotted, and slightly more when potted. Valve may be used in most hydraulic, pneumatic or cryogenic applications.—*Pneu-Hydro Valve Corp., East Orange, N. J.*

CIRCLE 505 ON READER SERVICE CARD

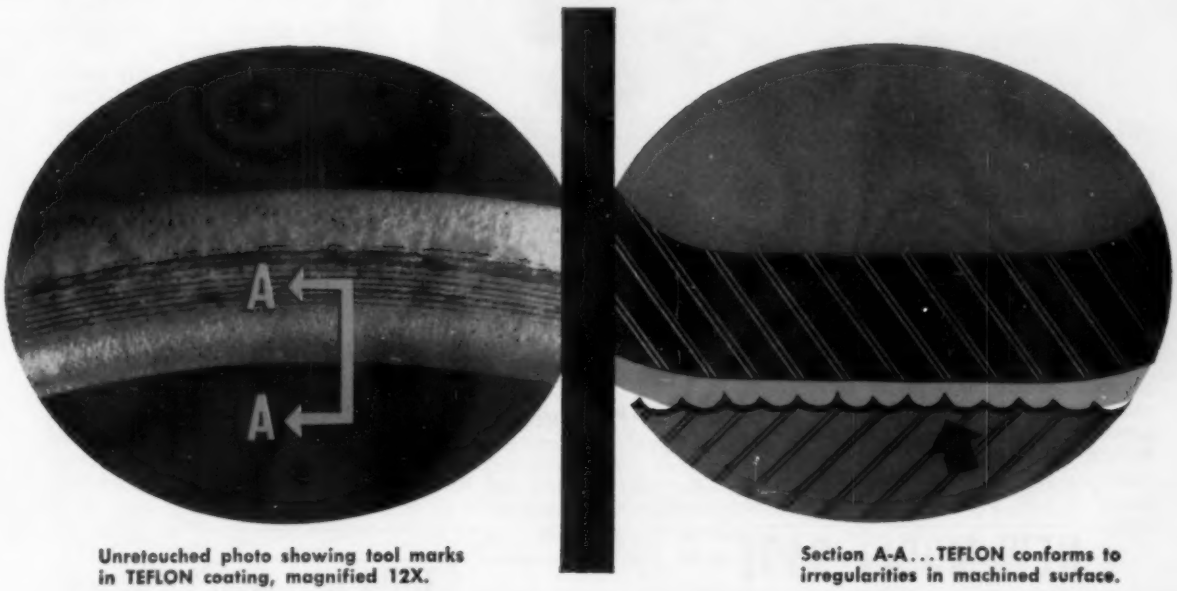
Continued on page 128

Magnified 12X reveals why Teflon* coated

UNITED METALLIC O-RINGS...

are the *perfect seals* for

LIQUID NITROGEN • LIQUID OXYGEN • AIR • FUELS



Unretouched photo showing tool marks in TEFLON coating, magnified 12X.

Section A-A...TEFLON conforms to irregularities in machined surface.

The 12X magnification proves that *Teflon*, permanently bonded to a United Metallic O-Ring, conforms to normal tool marks which it contacts in a machined seat. These microscopic valleys and ridges are exactly reproduced in reverse on the *Teflon* coating, as shown in photograph. This remarkable, non-porous, pliable coating compresses into these irregularities to help form a perfect seal.

United Metallic O-Rings, when *Teflon* coated, retain the spring steel characteristics of the metal, and provide the added advantage of the surface conformability of a rubber-like compound. Finish is completely non-corrosive and resistant to chemical action.

Extensive tests involving gases and liquids, at both high and low pressures, prove the absolute sealing action of *Teflon* bonded to stainless steel type 321 O-Rings. Tests included liquid nitrogen to —321° F. and hot air to +600° F. *Teflon* coated O-Rings are recommended for simple V-clamp installations, where they reduce the amount of compression-load required to make a positive seal.

United Metallic O-Rings may be made to practically any required dimensions.

Write for complete information.

*Teflon is the registered trademark for DuPont tetrafluoroethylene resins.

UNITED METALLIC "O" RING CORP.

Dayton, Ohio • Box 1035

Division of United Aircraft Products, Inc.

CIRCLE 130 ON READER SERVICE CARD

AVIATION COMPONENT DATA

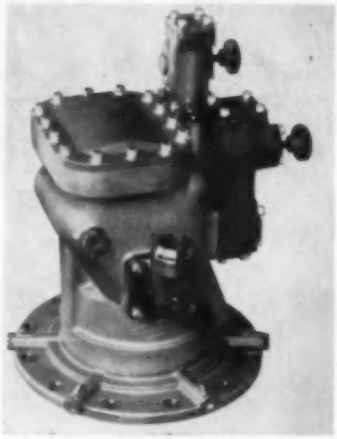
Fluorlastic Seals
. . . for static, dynamic use

New molded seals of fluorlastic Teflon have high flexibility and very good dimensional stability. Useful temperature range is —350 to 500 F. Material is tougher and more resilient than standard Teflon and resists all hydraulic oils as well as fuels, solvents and chemicals. —*Joclin Mfg. Co., Wallingford, Conn.*

CIRCLE 506 ON READER SERVICE CARD

Variable Delivery Pump
. . . for missile launching applications

For test stand use and other applications where 3000 psi is normally required but that call for reserve power. Pump has passed WADC 1000 hour endurance test operating at 5000 psi for over 100 hours. A high pressure, long life version of a standard model, fluid delivery is from 0 to 38.2 gpm, pressure from 0 to 5000 psi. Handwheel controls are provided for



manual adjustment. A variety of automatic controls are also available.—*Vickers Incorporated, Detroit, Mich.*

CIRCLE 507 ON READER SERVICE CARD

Valves & Pressure Switches

. . . for aircraft, rockets and missiles are listed and described in an eight-page bulletin. All pertinent characteristics—operating voltages, flow arrangement, flow capacity, flow factors, etc.—are covered.—*Robertshaw-Fulton Controls Co., Milford, Conn.*

CIRCLE 508 ON READER SERVICE CARD

Seal Compound
. . . for —80 to 400 F

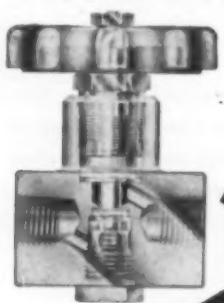
TH 1057 sealing compound is a fluorinated silicone rubber with excellent high and low temperature properties. One previously difficult problem which it solves very well is sealing silicone oils. The compound may be made into O-rings and other pressure-type seals. It has high extrusion resistance and resists many hard-to-seal fluids and air-fluid mixtures.—*Stillman Rubber Co., Culver City, Calif.*

CIRCLE 509 ON READER SERVICE CARD

Miniature Check Valve
. . . meets military specs

The photo shows the size 6 Republic Mini-Chek Valve compared with the size 6 conventional high pressure check valve. Both of these units operate on pressures up to

NEW MODEL 949T
MANUAL SHUT-OFF VALVE
...for superior valve leakage control by Circle Seal



CIRCLE SEAL

...easier operation with threads out of fluid stream, reduced operating torque...increased handle finger or detent depth and flow passages...for high or low pressure gas service...rated at 0-5000 psi

COMPLETE ENGINEERING DATA AVAILABLE
JAMES, POND AND CLARK INCORPORATED
2181 East Foothill Boulevard, Pasadena, California
REPRESENTATIVES IN ALL PRINCIPAL CITIES
See Our Catalog in Sweet's Product Design File

CIRCLE 30 ON READER SERVICE CARD

3000 psi won't get by the threads of Allen ○ Dryseals!

ALLEN 'TRU-ROUND' Dryseal Pipe Plugs
formed from special analysis ALLENOY steels.
Sold only through leading industrial distributors — specify genuine Allen Dryseal Pipe Plugs.
standard sizes from 1/16" to 1-1/4"

Here's the dependable, metal-to-metal seal you need for hydraulic systems . . . for transmission, control, and automated mechanisms where pressures run high. The N.P.T.F. threads of Allen ○ Dryseal Pipe Plugs are smooth, burnished, and burr-free — do their job without any help from sealing compounds. Allen's unique "pressur-forming" process assures the highest degree of precision threading and dimensional accuracy. What's more, Allen ○ Dryseals are precisely round at root, pitch and crest, with taper held to extremely close tolerances.

Allen engineers will gladly help you to harness your hydraulic pressures. Just write.

ALLEN
MANUFACTURING COMPANY
Hartford 2, Connecticut, U. S. A.

CIRCLE 7 ON READER SERVICE CARD

5000 psi. Although made of stainless steel, the weight of Mini-Chek is less than the usual aluminum

check valve for the same tube size. In spite of the smaller size the rated flow and the pressure drop characteristics meet or exceed Military Specifications MIL-V-25675.—*Republic Manufacturing Co., Cleveland, Ohio.*

CIRCLE 510 ON READER SERVICE CARD

Boot-Strap
. . . pressurizes hydraulic reservoir

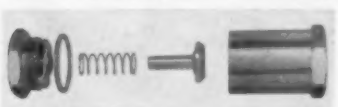
Assembly combines in one unit a hydraulic aspirator or jet pump, a pressure sensitive shut-off valve and a check valve. Unit functions to boot-strap pressurize a hydraulic

reservoir and pump suction by use of pump discharge pressure. Jet pump uses 0.55 gpm and will draw in sufficient air to increase the pressure in a 1000 cu. in. reservoir from zero to 40 psig in 1 min, 40 sec at sea level.—*Vinson Manufacturing Co., Van Nuys, California.*

CIRCLE 511 ON READER SERVICE CARD

Rotary Seals
. . . for —320 to 1200 F

For use with high-speed rotating shafts, these seals use a machined bellows spring seal with a sealing



face of carbon, tungsten carbide or other material depending on temperature and pressure. Seals may be used with hydraulic oils, silicone and other fluids.—*Skinner Seal Co., Santa Ana, Calif.*

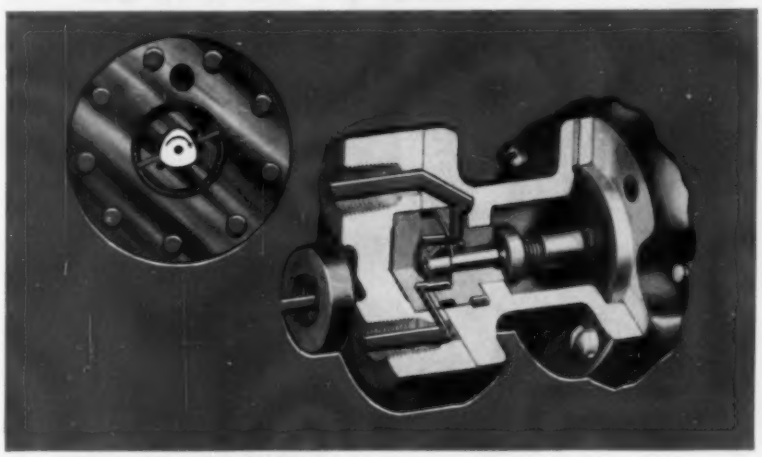
CIRCLE 512 ON READER SERVICE CARD

Continued on next page

YESTERDAY'S PIONEER . . . TODAY'S LEADER

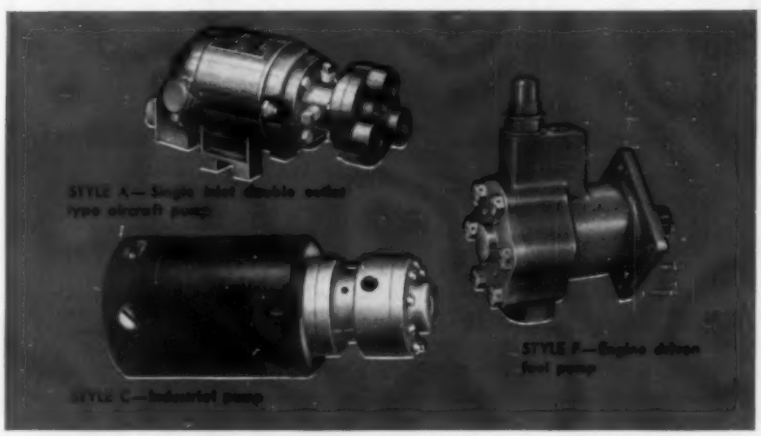
WELDON / FLUID METERING PUMPS

Positive Displacement Rotor Type. For Industrial Applications, Aircraft Anti-Icing and Aircraft Fuel.



IT'S SO SIMPLE!

The rotation of the rotor draws the fluid in through two passages, filling the cavities formed by the three lobes of the rotor. This fluid is sealed within these small cavities until it is forced through the two outlet holes by the floating blades. The flow may be kept uniformly divided through two outlet ports, or may be combined internally for passage through a single port.



COMPACT • LIGHT WEIGHT

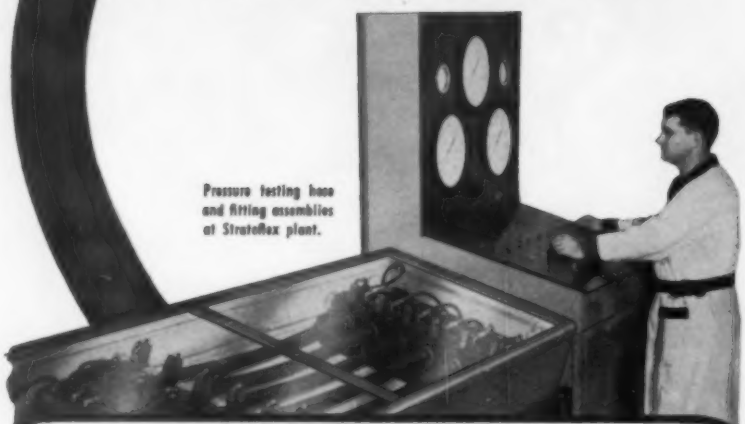
Send for Weldon Manual and Catalog with detailed specifications and installation drawings, covering the full range of Weldon pumps in various capacities. Specify your requirements.

THE WELDON TOOL COMPANY

3000 WOODHILL ROAD . . . CLEVELAND 4, OHIO

STRATOFLEX

Quality Control



Pressure testing hose and fitting assemblies at Stratoflex plant.

Your Assurance of that EXTRA Measure of Dependability in flexible Hose and Fittings

For dependable, trouble-free hydraulic and other high pressure fluid lines, specify Stratoflex hose and reusable fittings. Stratoflex hose and fittings are performance proved by the most advanced testing equipment available – your assurance of consistent high quality.

211—Medium pressure single wire braid hose. Temperature range: —40 to +275°F.

212—High pressure double wire braid hose. Temperature range: —40 to +200°F.

225—Medium pressure single wire braid hose. Temperature range: —40 to +200°F.

224—Medium pressure stainless steel wire braid cover and innertube. Weather resistant, non-inflammable. Temperature range: —65 to +450°F.

Call your industrial supply store or write for complete catalog.

STRATOFLEX Inc.

P.O. Box 10398 • Fort Worth, Texas

Branch Plants: Los Angeles, Fort Wayne, Toronto

In Canada: Stratoflex of Canada, Inc.

SALES OFFICES:

Atlanta, Chicago, Dayton, Detroit, Houston, Kansas City, Los Angeles, New York, Pittsburgh, San Francisco, Seattle, Toronto, Tulsa

AVIATION COMPONENT DATA

Spiral Wrap Hose
. . . resists impulse fatigue

Spiral wrapping of wire braid eliminates stress concentrations, prevents brinelling and provides high strength with no loss of flexibility. Hose is rated for 3000 psi. Teflon

tube makes the hose usable over a range of —100 to 500 F. Reusable "super gem" fittings have a metal-to-metal line seal as well as a lip seal formed by the tube and fitting. Positive fitting grip prevents blow off.—*Aeroquip Corp., Jackson, Mich.*

CIRCLE 513 ON READER SERVICE CARD

Gasket Catalog Sheet

. . . Still-Seal gaskets which provide full metal to metal contact are described in detail in an illustrated catalog sheet issued by the Still-Seal Gasket Dept., *Stillman Rubber Co., Culver City, California.*

CIRCLE 514 ON READER SERVICE CARD

Bypass Valve
. . . has low leakage

Designed for airborne use, leakage rate of this valve with 3000 psi applied to any other port is 5 cc/hr max from the drain port. Porting

arrangement is three-way, two-position. For use with hydraulic fluids, the valve meets military standards. Temperature range is —65 to 275 F. Operating pressure is 3000 psi.

Solenoid current drain is 1.6 amp at 29 v dc at 70 F. Actuation time is 0.15 sec, max. Weight is 1.75 lb. —*M. C. Mfg Co., Lake Orion, Mich.*

CIRCLE 515 ON READER SERVICE CARD

Sensitive Pressure Switch

. . . has low operating differential

Weighing 1.25 lb, this all-aluminum pressure switch is 6⅜ in. in dia. and 3-¾ in. deep. External adjustment is provided of differential pressures from 1 to 22 in. of

water or 0.1 to 5 in. of mercury. Reference pressure fluid may be air or inert gas and variable pressure fluid may be liquid or gas. Fixed actuation values range from 1.25 to 12 in. of water.—*Meletron Corp., Los Angeles, Calif.*

CIRCLE 516 ON READER SERVICE CARD

3000 PSI Water Pump

. . . is self lubricated

For applications requiring a low flow and a high pressure, such as actuating landing gear on missiles or aircraft. An integrated reservoir containing a water soluble oil and an internal charge pump provide

the necessary lubrication of the pump components. The pump uses a unit of five axial pistons, located in a stationary block, actuated by a rotating wobbler. The motor is 400 cycle, 200 v 3 ph. Pump output is 1 gpm at 3000 psi. Duty cycle is 1 min "ON" and 5 min "OFF".—*Lear-Romec Div., Lear, Inc., Elyria, Ohio.*

CIRCLE 517 ON READER SERVICE CARD

Your Tight Specifications Require the Tightest Seal!

MARSH IMPREGNATED THERMO-LEATHER PACKINGS

. . . still the BEST by TEST and USE

MARSH has the *right* answer to your specific packing requirements. Extensive research plus nearly 60 years of packing experience is your assurance of complete satisfaction in every application.

- Low coefficient of friction
- Greater wear resistance
- Tighter sealing
- Temperature stability

HERE'S A HELPING HAND

FOR YOUR PACKING PROBLEMS

Engineering and Consulting Service

If you seal oil, water, air, vacuum, gas, gasoline, naptha, alcohol or other fluids, ask MARSH for field engineering service, immediately available to you for the job you are designing, tooling, manufacturing.

MARSH BEST SINCE 1900 LEATHER PACKINGS

LEATHER—The No. 1 Sealer

Field experience is continuously proving —on job after job—that leather, both standard and impregnated, is still far superior to all other types of material—since it is the only known media which has the fine needed desire in installation of conforming to the house in which it is placed.

Let's solve your packing problems together!

C. W. MARSH COMPANY

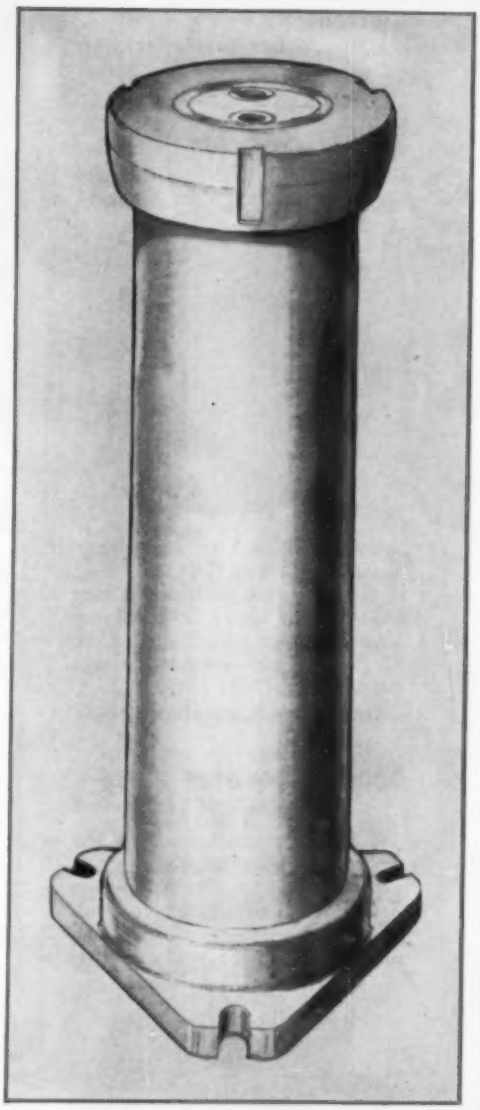
MAIN OFFICE AND FACTORY • MUSKEGON, MICHIGAN

SALES OFFICES: 75 E. Wacker Drive, Chicago 1, Illinois · 101 Park Avenue, New York 17, New York · 1900 Euclid Avenue, Cleveland 15, Ohio

CIRCLE 79 ON READER SERVICE CARD

BACKED BY A QUARTER OF A CENTURY OF LOCKHEED HIGH-PRECISION HYDRAULICS

LOCKHEED *hydraulic* ACCUMULATORS



These accumulators are of the type in which the compressed gas is separated from the hydraulic fluid by a piston, a principle which has been found to be superior to the more conventional rubber bag on grounds of long life and reliability.

The workmanship throughout is of the typical Lockheed standard, the cylinders are honed and hard-chromed to a very high finish. The floating pistons have special fabric-faced synthetic rubber seals, ensuring a very long life. The end plugs have synthetic rubber seals, and are held against the internal pressure by screwed end caps.

The illustration shows a typical accumulator which is available for pressures up to 2,000 p.s.i. or 3,000 p.s.i. and in capacities from 50 to 5,000 cu. in. These units may be used in conjunction with an auxiliary gas compression bottle in order to reduce the pressure differential between full and discharged condition, or increase the capacity.

Full particulars of these will be sent on application: kindly mention this journal.

AUTOMOTIVE PRODUCTS COMPANY LIMITED
SHAW ROAD, SPEKE, LIVERPOOL
Telephone: Hunts Cross 2121

Lockheed
REGD TRADE MARK
INDUSTRIAL HYDRAULICS

COMPLETE INSTALLATIONS BRITISH MADE OR INDIVIDUAL UNITS

NEW PRODUCTS

SOLENOID VALVE
. . . offers high flow at low cost

Designation: L Series

Features: This series of 2-way, normally closed valves is pilot operated. Valves open to a full ½ inch orifice. Connections are either

⅜ or ½ inch NPT. A soft, synthetic insert provides bubble-tight operation. In addition to the normally closed valves the L series is also available for normally open operation and with such options as manual over-ride, explosion-proof construction and a choice of electrical connections. Maximum operating pressure is 150 psi in a temperature range from —40 to 180 deg F.

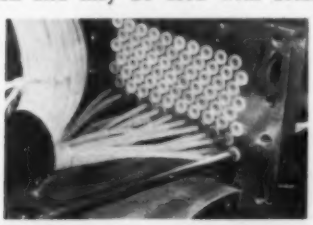
Skinner Electric Valve Division
New Britain, Connecticut

CIRCLE 307 ON READER SERVICE CARD

COMPRESSION FITTING
. . . fits into drilled hole

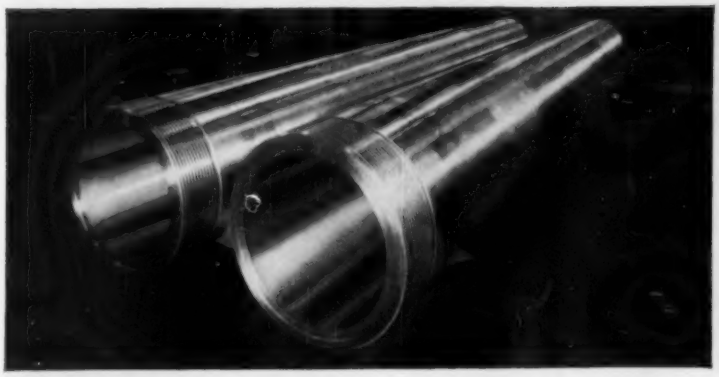
Designation: Presslok

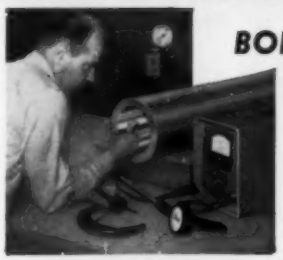
Features: Fittings are made of nylon and may be used with brass,



copper, steel or nylon tubing. Installation requires only a drilled hole with no reaming or tapping. Fitting is compressed into hole

Continued on page 134





BORED and HONED to MIRROR FINISH

American, specialists in boring and honing of hydraulic or air power cylinders, is your dependable source. We work in any material to your specifications. Write or phone us for estimates.

TELEPHONE ERIE 2-3664

PRECISION INTERNAL MACHINING AHB

MANUFACTURERS OF HYDRAULIC CYLINDERS • SPINDLES • SLEEVES CLUTCH SHAFTS • PISTON RODS • RAMS • QUILLS, ETC.

AMERICAN HOLLOW BORING CO.
1954 Raspberry St., Erie, Pa.

NEW . . . "in-line" CONSTANT, HIGH WORKING PRESSURE FILTERS

BRIGGS 0 to 3000 PSI HYDRAULIC FLUID FILTERS

SHOCK . . and vibration take a back seat with Briggs new HY-Series Hydraulic Fluid Filters . . made especially for equipment demanding constant high working pressures.

IF YOU ARE HAVING TROUBLE with sticking valves . . erratic machine performance . . if you are not getting full, easy and efficient production from your hydraulically operated equipment, write today for our new bulletin C-26A. It's packed full of complete specs . . data you can use . . and scale drawings to help you in your calculations.

Exploded View Showing Construction

Briggs — PIONEERS IN MODERN OIL FILTRATION

HYDRAULIC OIL AND FLUID FILTERS

PRODUCT OF CONSTANT RESEARCH

with interchangeable cartridges for mineral oils, additive oils or non-inflammable fluids . . . for by-pass, in-line or high flow installations

SEND COUPON FOR NEW BRIGGS BULLETIN C-26A

THE BRIGGS FILTRATION COMPANY, DEPT. 233, WASHINGTON 16, D. C.
SEND BULLETIN C-26A, without obligation, describing your new in-line, high pressure hydraulic fluid filters.

Name .....
Company .....
Address .....

NEW PRODUCTS

with a special driving tool. Tests show fittings stand up under pressures to 1200 psi. Fittings can be spaced with a clearance of as little of 1/16 inch between fitting O.D.

Specifications: Available in 7 sizes at 1/16 inch intervals for O.D. tubing sizes from ⅛ to ½ inch.

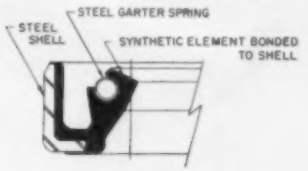
Nylon Molding Corp.
Garwood, New Jersey

CIRCLE 308 ON READER SERVICE CARD

SHAFT SEAL
. . . for large diameter shafts

Designation: Model 73-B

Features: Available for shaft diameters from 8 to 46 inches. Synthetic rubber sealing element is resistant to oils, greases, water, mild acids and alkalies. Will withstand operating temperatures from —40 F to 250 F. Additional compounds such as silicone rubber are available. The seal is fitted with a garter spring of steel or stainless steel. The shell is also of steel or stainless steel.



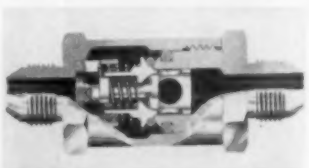
Garlock Packing Company
Palmyra, New York.

CIRCLE 309 ON READER SERVICE CARD

CHECK VALVE
. . . houses max pressure relief

Designation: Model No. P389

Features: Valve combines check valve with maximum check-pressure relief in single housing. Relief element protects system against over pressurization from thermal



expansion. Check valve uses floating O-ring seal. Relief unit seals with no leakage to cracking pressure.

Specifications: Check valve cracking pressure 1 psi. Relief cracking pressure 400 psi. Max operating pressure 500 psi. Tube sizes ¼ to 1 inch.

James, Pond & Clark, Inc.
Pasadena, California

CIRCLE 310 ON READER SERVICE CARD

A. C. MOTORS
. . . in new frame sizes

Designation: Series D

Features: Motors use the new, large NEMA frame 364U through 445U. Foot-mounted and footless horizontal models in the 360 frame diameter are stocked in all standard enclosures—protected, totally-

enclosed, fan-cooled, corrosion-proof, and explosion-proof. Units are for operation on 208 through 550 volt in-plant A.C. Other new

The ARROW AUTOPNEUMATIC CONTROL is the answer to your compressed air problems

Write for Free Catalog

ARROW TOOLS, INC.
1934 S. Kostner Ave.
Chicago 23, Illinois

CIRCLE 13 ON READER SERVICE CARD

NEMA frame sizes through 125 hp., with their modifications, are being made available. In NEMA electrical design B, design C and design D, motors may be specified in a number of speeds, with class A, class B or high-temperature class H insulation. Part-winding starting is available.

Reliance Electric and Engineering Co.
Cleveland, Ohio

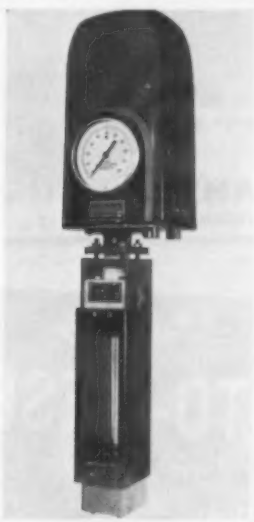
CIRCLE 311 ON READER SERVICE CARD

FLOW TRANSMITTERS

. . . feature versatility

Designation: TransiTwins

Features: "Mag/Nu/Matic" pneumatic transmitter employs direct force balance to minimize mechanical motion, providing low inertia characteristics and fast response. Three screw driver adjustments take



care of range, linearity and zeroing. "Elec/Tru/Matic" electric transmitter utilizes a strain gage element arranged as a Wheatstone bridge. The unit can be used with various receiving instruments. The standard model is explosion proof. Available transmitter-meter combinations will measure air flows from .18 to 3000 SCFM, water flows from .06 to 1500 GPM.

Brooks Rotameter Co.
Hatfield, Pa.

CIRCLE 312 ON READER SERVICE CARD

VANE COMPRESSOR

. . . weighs only 55 lbs.

Designation: Model R-1

Features: For general utility purposes, unit is manufactured in 1½ and 2 hp ranges. Develops up to

Continued on page 137

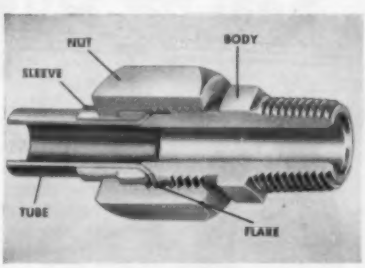
New Parker No-Skive Hoze-lok

FASTER . . . EASIER . . . RE-USABLE

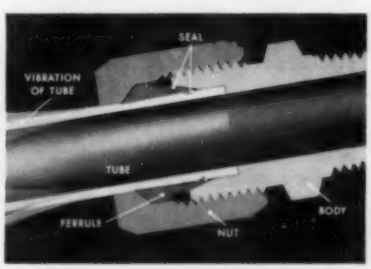
No more frustrating jobs of stripping covers from hydraulic wire-braid, rubber-covered hose! No more ragged hose ends refusing to enter sockets!

New Parker Hoze-lok Fittings save you all this time and trouble. Skiving of hose covers is *not* necessary. Simply screw the nipple in to complete the make-up. What could be easier . . . or more effective?

Versatile Hoze-lok Fittings are reusable . . . an important benefit to users of your equipment. Select your Hoze-lok Fittings now from the new, wide range of styles and sizes, with four different connecting ends and full range of adapters. Send for Catalogs 4433, 4434.



Triple-lok Flare Fittings . . . the easiest, fastest, safest way to tube up even in close quarters. Leakproof even under severe vibration, high pressures. Meet S.A.E. Standard. Catalog No. 4310.



Ferulok Flareless Fittings for high-pressure heavy-wall tubing. Double seal makes Ferulok leakproof, vibration-proof. You can see the "bite." Meet S.A.E. Flareless Standard. Catalog No. 4320.

PARKER FITTINGS AND HOSE DIVISION

Section 431-B, Parker-Hannifin Corporation, 17325 Euclid Ave., Cleveland 12, Ohio

Parker Hannifin
creative leader in fluid systems

CIRCLE 97 ON READER SERVICE CARD

AUTOMATIC REMOVAL

MOISTURE VAPOR HUMIDITY

FROM COMPRESSED AIR

Van-Air® DRYER

Unique in moisture-control, Van-Air Dryers do more than trap condensed liquids from compressed air lines. They remove vapor-humidity to *LOW DEW POINTS* besides eliminating water and solid impurities from raw compressor air.

Van-Air Dryers eliminate elusive trace vapors that condense at line-extremity temperatures and cause untold product spoilage, instrument failure and operational down-time. Where air must be of clean, dry, instrument quality as in automation, product finishing, processing foods, chemicals, plastics, etc., these Dryers are proving highly efficient—*AND*, they work for pennies instead of dollars. Available in many capacities up to 5000 SCFM and pressures up to 3000 psi. Van-Air Dryers are used by hundreds of plants from coast to coast.

When air-line moisture is a problem in your plant, Van engineers will be glad to help. Write or phone .—Erie 3-5556. Meanwhile, ask for useful handbook, "Air, Water and Industry."

SEND FOR BROCHURES OF

Van-Air and Vi-Speed

PNEUMATIC EQUIPMENT

SHOWING UNIVERSAL AIR CYLINDERS, BENCH-TYPE and DEEP-JAW AUTOVISES, BENCH and ARBOR PRESSES ENGINEERED FOR AUTOMATION BY

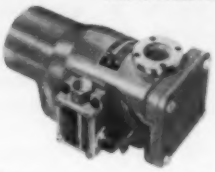
VAN PRODUCTS CO. • MFRS.
SWANVILLE ROAD, ERIE, PA.

CIRCLE 134 ON READER SERVICE CARD

CIRCLE 107 ON READER SERVICE CARD

PATENTS APPLIED FOR

Oil filters that tell when they're dirty... will never starve a pump... are easy to clean... are full flow

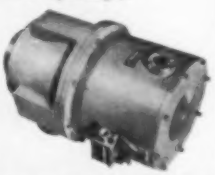


SEE condition of oil thru glass
FULL FLOW by-pass when filter is clogged
TELLS when to clean, by remote signal switch
EASY access to dirty cartridge

Above: 20-gpm Tell-Tale unit. Can be upped to 40 gpm with pleated filter cartridge. 50-gpm and 75-gpm Tell-Tale units (not shown) are also available.

Left: Removing the filter cartridge from a 5-gpm Tell-Tale unit. Pleated filter rating for this same unit is 10 gpm. While the optional electrical limit switch indicator is shown here, the visual indicator model is also available.

Below: 100-gpm Tell-Tale filter. Pleated filter rating is 200 gpm. All cartridges, plain or pleated, are available in five different degrees of filtration (from .0008 to .009" openings).



Rosaen Tell-Tale® units do more than filter. They indicate when the filter needs cleaning. And if ignored they by-pass oil to protect the pump (and they indicate this, too). Filters are necessary, but the high cost of filter inspection is not. Get the filter that tells when to clean, and never starves a pump. Write for more information.

The ROSAEN COMPANY
1776 EAST NINE MILE ROAD • HAZEL PARK, MICHIGAN

Dealers: Write for information

You Get

POSITIVE Seal for Oil

..by using

AUTO-DIESEL
2 or 3 piece
Hydraulic Seal Rings

Because Auto-Diesel 2 or 3 Piece Hydraulic Seal Rings HAVE NO GAPS they will take high pressure and are especially effective for sealing oil. They will give you more positive sealing than one piece rings. They are made for high pressure service in air, steam and hydraulic cylinders. Perhaps you need a ring to meet a special problem. Auto-Diesel Engineers have years of experience in developing rings for all types of industrial use. You may consult our Engineers about any ring problem you have. Auto-Diesel 2 or 3 Piece Hydraulic Seal Rings are made of cast iron, steel, bronze or aluminum in sizes up to 35". Why not find out what they will do for you?

Phone Our Representative Nearest You
Chicago Rep.—Vince Holstrom Phone RO 1-2029
Detroit Rep.—Clifford-Rockwell Co. Phone DI 1-8873

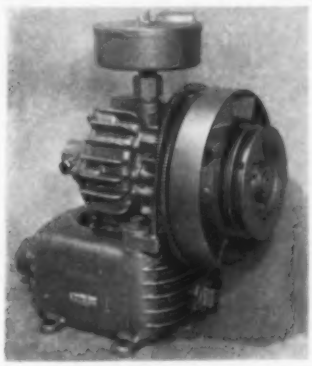
Write for Details

THE AUTO-DIESEL PISTON RING CO.
3137 Superior Avenue • Cleveland 14, Ohio
"RINGS and SHAPES Since 1921"

CIRCLE 15 ON READER SERVICE CARD

NEW PRODUCTS

200 psi with a discharge air temperature of about 200 F. A self-contained circulating oil system both seals and lubricates. A filter system completely removes oil from compressed air and returns it to a



sump. Cut-off switch prevents operation if oil level drops too low.

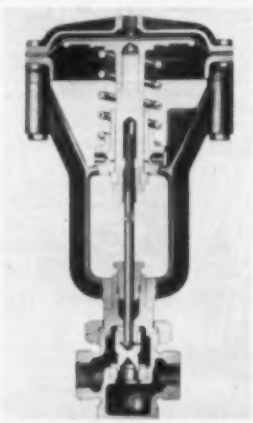
Kellogg Div.
American Brake Shoe Co.
Rochester, N. Y.

CIRCLE 313 ON READER SERVICE CARD

DIAPHRAGM OPERATED VALVE

. . . uses V port valve element

Features: V-port design is said to give extremely precise modulation of flow because of its tapered variable port area. The valves are de-



signed primarily for instrument actuated control of temperature, pressure or flow.

Specifications: Intended for steam, air, liquid or gas service up to 250 psi. Sizes range from 1/16 to 2 in. NPT (direct acting) and ⅛ to 2 in. NPT (reverse acting). The valve bodies are cast of Navy M bronze. The V port disc is made of cast Stellite and the seat of Stellite-faced K-monel.

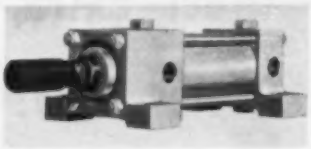
Sinclair-Collins Valve Company
Akron, Ohio

CIRCLE 314 ON READER SERVICE CARD

HYDRAULIC CYLINDER

. . . designed to heavy duty standards

Features: The cylinder has been designed stress-wise and bearing-wise to be fully capable of performance in 1000 psi service with a minimum 4:1 safety factor to the yield point for all parts. All metal parts are treated for corrosion re-



sistance with either Cadmium plate or oiled black oxide.

Petch Manufacturing Co.
Detroit, Michigan

CIRCLE 315 ON READER SERVICE CARD

Continued on next page

Lincoln AIR AND HYDRAULIC Cylinders

The answer to the increased demand for rugged, heavy duty air and hydraulic cylinders. Designed for the hardest usage in Steel Mill operation or for the hundreds of other modern cylinder applications that require dependable efficient service.

Lincoln MACHINE CO. INC.

P. O. Box 272 EDgewood 2-4689 Salem, Ohio

CIRCLE 75 ON READER SERVICE CARD

Order Extra Copies Now!

JANUARY 1958

Designers' Guide Issue

Single Copy Price $1.00
25 to 50 copies, ea. .. .75
50 or more copies, ea. .40

98 PAGES OF SPECIFICATION CHARTS

Accumulators	Air Motors
Aftercoolers	Electric Motors
Air Compressors	Fluid Motors
Oil Coolers	Packings
Air Cylinders	Gear Pumps
Oil Cylinders	Vane Pumps
Air Filters	Piston Pumps
Oil Filters	Limit Switches
Hose Assemblies	Pressure Switches
Hose Fittings	Timers
Tube Fittings	Air Valves
Fluids	Hydraulic Valves
Pressure Gages	Directional Control
Joints	Flow Control
Lubricators	Pressure Control

- Pressure ratings
- Types
- Capacities
- Speeds
- Mountings
- Sizes

Order from:

Applied Hydraulics

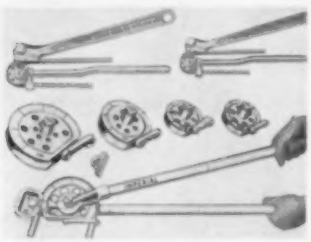
812 HURON ROAD
CLEVELAND 15, OHIO

NEW PRODUCTS

TUBE BENDER
. . . for many tube sizes

Designation: Blue Dot

Features: Bender design permits bending hard and soft tubing and the handling of from 2 to 7 sizes



of tubing. Sizes of tubing range from ¼" to ⅞" O.D. Benders for 4 or more sizes are furnished in metal kits. The benders are adapted for various sizes of tubing by changing forming wheel and shoe.

Imperial Brass Mfg. Co.
Chicago, Illinois

CIRCLE 316 ON READER SERVICE CARD

Continued on page 140

Versa "A" Valves

Give MAXIMUM Capacity In MINIMUM Space...

- Versa solves the space problem with a truly economic valve.
- The overall size of the Versa "A" valve is only 2" high by 1" in diameter, yet it has the capacity of much larger valves.
- Ideal for controlling cylinders, instruments and larger pilot valves.
- Available in ⅛" NPT in 2-way & 3-way types with or without button guard, in either normally open or closed models.
- Simple to mount on equipment or can be furnished for panel mounting.
- Prices range from $4.00 to $6.50 each.
  For complete information write today for Folder #143.

VERSA

VERSA PRODUCTS COMPANY INC.
248A SCHOLES STREET, BROOKLYN 6, N.Y.

FREE CATALOG! Write today for your free copy of Versa's Catalog #14.

CIRCLE 135 ON READER SERVICE CARD

SAVE WORLD'S LARGEST ON-THE-SHELF STOCK of HYDRAULICS

NEW PALLEY HYDRAULIC CYLINDERS
Shown here are two types of our newly developed lines of Hydraulic Cylinders. These Cylinders are designed to meet the most rigid requirements of Industry. All are double action with rugged steel construction. Type (B) is a flange mounted, Press Type which delivers up to 21,000 lbs. thrust at 3000 PSI. Type (A) is a heavy duty, external cap cylinder which ranges up to a thrust of 37,500 lbs.

B AS LOW AS 56.45

A 36.00 AND UP

For complete listing of our prices & tremendous stocks send for Catalog below.

NEW **4-WAY – SLIDING PISTON HYDRAULIC VALVE**
A newly developed valve which can be connected in series to operate two or more Hyd. Cylinders, independently or in unison. Has built-in relief valve, adjustable from 1200 to 3000 PSI. Max. flow 10 GPM. Available in 2000 PSI at $24.50 or 3000 PSI at $32.75.

WORLD'S MOST AMAZING CATALOG

NATIONALLY ADVERTISED MERCHANDISE NEW and USED GOV'T SURPLUS

396 PAGES

This catalog features the Largest Stock of Hydraulic Equipment and Supplies ever seen under one roof! This includes our own line of Hydraulic Cylinders as well as over 50,000 Gov't Surplus Cylinders. Also Hyd. Valves, Pumps, Motors, Tubing, Hardware, Plumbing, etc. plus a complete stock of Electric Motors, Power Tools, Plant & Office Equip., etc. Send for Your Copy Today and Save!

GOV'T SURPLUS BUYS

VICKERS HYDRAULIC ANGLE PUMPS
Made to top aircraft specs.

Cat. No.	GPM	PSI	RPM	Price
H-P4A	5.3	1000	3000	$22.50*
H-P5A	2.7	1500	3000	25.75*
H-P4U	6	1000	3000	22.50*

*Used but excellent condition.

2000 PSI HYDRAULIC CYLINDER SPECIAL Only 12.75

Genuine top quality Gov't Surplus. Used but excellent condition. Has a Bore of 2-1/4", Shaft 1", Stroke 4". Eye-to-eye lgth. 13½". Ports 1/4" AN.

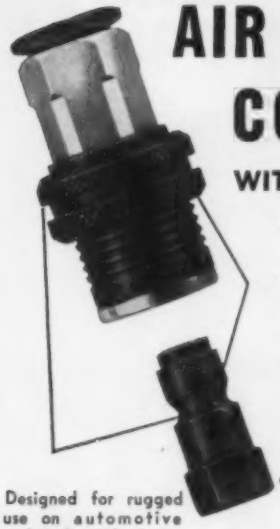
TERMS: Send Check, Cash or Money Order. 50% Deposit with C.O.D.s. Prices F.O.B. Los Angeles, Calif. Warehouse.

Palley's

2263 E. Vernon Ave., DEPT. AH-38
Los Angeles 58, California

CIRCLE 96 ON READER SERVICE CARD

CIRCLE 27 ON READER SERVICE CARD



AIR & STEAM COUPLERS

WITH SLEEVE RINGS

- Heavy duty construction with check valves in coupler bodies.
- Sleeve rings materially aid in connecting and disconnecting.
- Operator can easily couple or uncouple line even with heavy gloves or oily hands.
- Available in the "R" series for air or the "S" series for steam.
- "S" series ideal for steam molds, vulcanizers, steam cleaners, sterilizers, etc.
- Both "R" and "S" series available in 3 basic body sizes with pipe threads from ⅛" to ¾".

Designed for rugged use on automotive and industrial air or fluid lines and steam installations up to 180 lbs. pressure or 380° F.

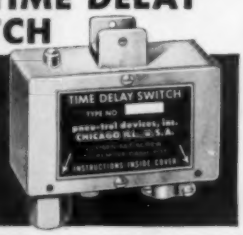
WRITE FOR CATALOG PAGE — Form 57-11C

TRU-FLATE® INC.

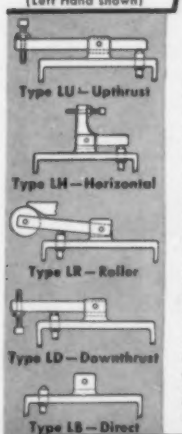
889 — 92nd AVENUE • OAKLAND 3, CALIFORNIA

Pneu-Trol TIME DELAY CONTROL SWITCH

...Gives Cylinder Applications Greater Efficiency Accuracy ...Wider Use!



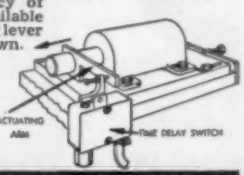
For any type actuation Left or Right Hand. (Left Hand shown)



- **Holds Cylinder dwell accurately to fraction of second.**
- **Automatically re-sets.**
- **Simple, Compact, Rugged.**

You can hold any motion or operation controlled or actuated by air or hydraulic cylinders at a positive stop on either end of the stroke for ¼ to 60 seconds in 20 to 1 ratios with Pneu-Trol Time Delay Control Switches. Simple in design with positive hydraulic timing action . . . compact and easily mounted on the machine or fixture, Pneu-Trol Switches are providing millions of trouble-free actuations in solenoid-operated cylinder applications of every type. Positive, controlled time dwell permits wider use of air or hydraulic power in automatic operations, increases accuracy of work by insuring split-second accuracy of the dwell. Available with 5 actuating lever linkages as shown.

Switch mounted to provide dwell at end of power stroke of single action, spring return cylinder.



Pneu-Trol DEVICES, INC.

7424 N. BEATING AVENUE - CHICAGO 31, ILL.

CIRCLE 101 ON READER SERVICE CARD

O-RINGS

CUSTOM MOLDING • CUSTOM COMPOUNDING

If you're looking for O-rings to perform under today's greater temperature ranges, higher pressures, and other severe conditions, look to Goshen. Here custom compounding of natural, synthetic and silicone rubbers is performed by experts in developing the exact combination of properties required in *your seal*. GRC O-rings are available in a complete range of AN, MS, SAE and JIC standard sizes, plus many non-standard sizes and special shapes. We'll gladly work with you in adapting to your application the correct GRC O-ring.

Ask for free copy of GRC O-ring brochure. 16 pages of useful information.

QUALITY ENGINEERED RUBBER PRODUCTS

Goshen Rubber Co., INC.

1338 S. TENTH ST. GOSHEN, IND.

CIRCLE 51 ON READER SERVICE CARD

CIRCLE 1 ON READER SERVICE CARD

only the **Fall** Gets it All!

WHY be satisfied with only partial removal of dirt or other foreign accumulation from piston rods when you can—

Remove ALL the Dirt from Rod O.D. Stop Dirt Passing Through the Ring Joint with a

Fall "CJ" WIPER RING

The Ring with a Closed Joint!
SPRING LOADED
with Squeeze Grip Action

If you have a wiper ring problem write, wire or phone us.
All Fall Rings are covered by patents issued or patents pending.

ACE PRODUCTS CO.,
Toledo 1, Ohio
Phone Cherry 3-6513

You Can Depend on ACE Products—Established 1935!

IMMEDIATE DELIVERY

contour cutters for popular hydraulic ports!

One pass completes all operations necessary to produce the port contour. Job time cut as much as ⅔! All have carbide cutting edges for long life, smooth finishes. Available in all sizes. Write for prices.

SONNET
Tool and Mfg. Co.
576 North Prairie Avenue
Hawthorne
California

NEW PRODUCTS

FLOW CONTROL
. . . has built in pressure relief

Features: New unit is a non-adjustable by-pass and restrictor type flow regulator and an adjustable, damped relief in a single housing. Dual unit reduces piping and fittings, simplifies circuitry and lowers cost. Can be used as a high capacity relief valve, as a remotely

operated relief valve, to replace a pump for power steering or to provide a small flow for a control system.

Specifications: Maximum operating pressure 3000 psi. Relief pressure adjustable in three ranges. Port connections ½, ¾ and 1 inch.

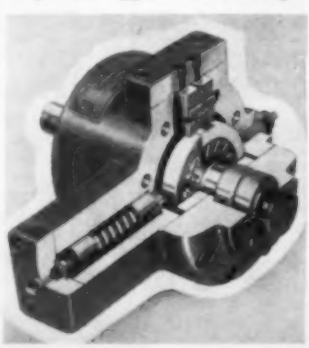
Fluid Controls, Inc.
Mentor, Ohio

CIRCLE 317 ON READER SERVICE CARD

VANE PUMP
. . . gives variable output to 10 gpm

Designation: Model S

Specifications: Pump has a capacity of 10 gpm and is designed



to operate at 1000 psi and 1800 rpm. The pump is subplate mounted, which added to the simplicity of design, makes for overall

FOR MORE INFORMATION-USE A TIME-SAVER CARD

If you want details about products described or advertised in this issue, circle the number on the card that corresponds with the number under each advertisement or product description. NO POSTAGE NECESSARY IN U.S.A.

efficient functioning of the entire unit. Variable-volume vane design is available with several different volume controls.

Racine Hydraulics & Machinery, Inc.
Racine, Wisconsin

CIRCLE 318 ON READER SERVICE CARD

RUBBER COMPOUND
. . . for high temperature seals

Designation: Compound No. 85-138

Features: Material proposed for O-rings and custom moulded parts used in high temperature seals. Recommended for short periods at temperatures as high as 600°F. Material has a Shore A hardness of 50°, a tensile strength of 800 psi and an elongation of about 250%. Compression set after 24 hours at 450°F is approximately 25% by thickness. After air-aging at 600°F for 48 hours, tensile loss is about 35%, elongation is 59% and hardness increase is 15° Shore A.

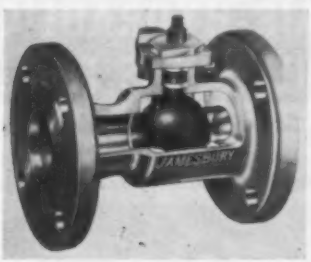
Parker-Hannifin Corp.
Cleveland 12, Ohio

CIRCLE 319 ON READER SERVICE CARD

FLANGED BALL VALVE
. . . in small sizes

Designation: Double-Seal

Features: Ball valves are now supplied with flanged ends in pipe



sizes from ½ to 8 inches. Offer full pipe-line flow, no leakage, no lubrication necessary and minimum maintenance. Operating torque is low over the full pressure range. Seats and seals are interchangeable and replaceable.

Jamesbury Corp.,
Worcester, Mass.

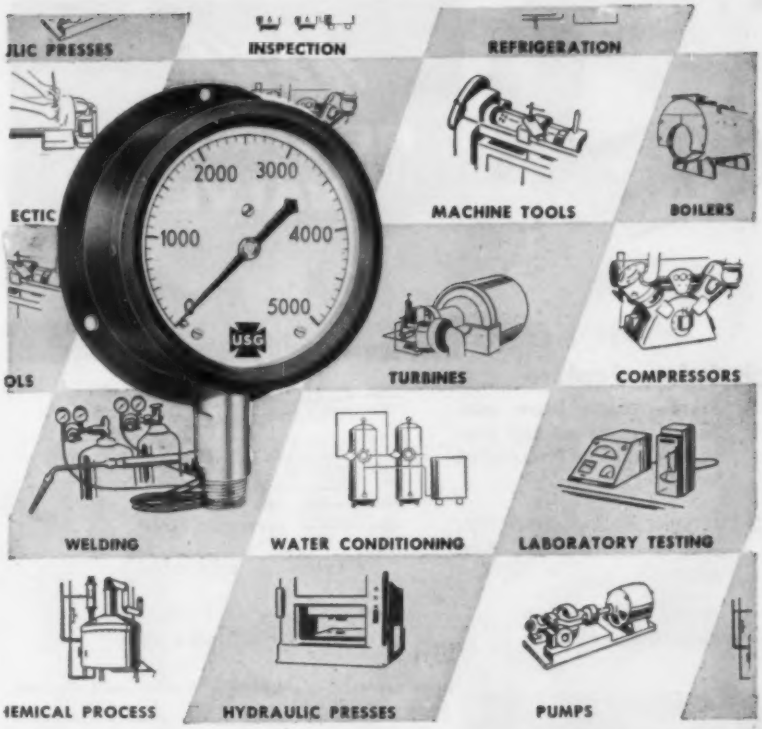
CIRCLE 320 ON READER SERVICE CARD

METERING VALVE
. . . offers fine adjustment

Designation. PY270

Features: The valves are equipped with a slow rising stem which requires twenty turns from closed to full open. Orifices are either

Continued on page 143



industry buys more USG gauges than any other make

HERE'S WHY

- Practically all industrial gauge requirements can be met by USG.
- For high sustained accuracy . . . for long, trouble-free service under severe temperature and atmospheres . . . there's the Supergauge and Solfrunt Series.
- For less exacting applications there are thousands of gauges . . . cast case and drawn steel case units . . . each with components specially qualified for its particular function.
- Every gauge is backed with more than 50 years experience in gauge construction . . . with research that puts every type of gauge through simulated service conditions for months before it is marketed . . . with quality control that enables USG to guarantee performance in service.
- Buy USG gauges . . . pressure and temperature pilots, recorders and controllers . . . transmitters and thermometers . . . and be assured of guaranteed satisfaction in quality, performance and dependability.

Consult the "Yellow Pages" of your phone book for the name of your USG distributor. Call him or write the factory for catalogs.

Supergauge and Solfrunt Reg. T.M.

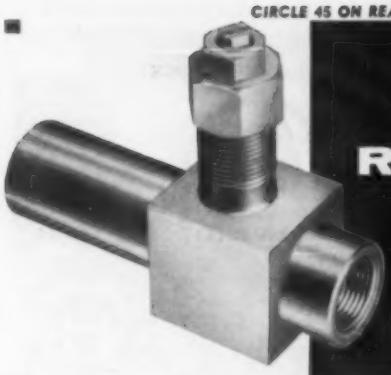
USG
Home of the SUPERGAUGE

UNITED STATES GAUGE
Division of American Machine and Metals, Inc.
Sellersville, Pa.

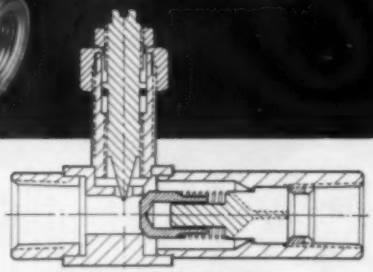
MORE THAN 50,000 TYPES OF GAUGES • SUPERGAUGES • SOLID FRONT GAUGES • RECEIVER GAUGES • TEST GAUGES • RECORDERS • CONTROLLERS • TRANSMITTERS • PSYCHROMETERS • AVIATION INSTRUMENTS

CIRCLE 132 ON READER SERVICE CARD

CIRCLE 45 ON READER SERVICE CARD



NEW * RESTRICTOR VALVES



FREE FLOW
RESTRICTED FLOW

*** Safety Feature**
Stem cannot blow out. Safety retention cap prevents complete removal of needle.

*** Increased Capacity**
. . . in the restricted flow direction.

Write for detailed specification

- Externally adjustable
- For oil
- Pressures to 3,000 psi.
- ⅜" & ¾" pipe sizes

Fluid Controls, inc.

Member of Fluid Power Association

Manufacturers of Hydraulic Valves and Devices

Relief Valves • Check Valves • Restrictor Valves
Needle Valves • Pilot Check Valves • Special Valves
Pressure Compensated Flow Regulators

1284 N. CENTER STREET • MENTOR, OHIO

CIRCLE 99 ON READER SERVICE CARD

HAND HYDRAULIC PUMPS

Single and Double Designs to 20,000 PSI With or Without Reservoir

160 Cubic Inch Reservoir with 8" x 8" Base Plate. Optional Size Piston: ⅜", ½", ¾", 1".

Handle length: 18 inches
Catalog No. 160

We specialize in hand pump units to operate in temperatures from minus 65F to plus 160F and with any capacity reservoirs required.

The single pump with ½", ¾", 1" or 1½" piston now available in stainless steel.

WILLIAM S. PINE
Hydraulic Hand Pumps for 1001 Uses
1635 E. 22nd St., Los Angeles 11, Calif.

What a sight!

CENTURY'S
All-new Oil Level Sight Gage

- No Easier Installation Ever Designed
- Better Visibility at any Height
- Leak-proof—No Dripping
- Streamlined Modern Appearance
- Important Savings in COST
- Available NOW From STOCK

Send for new catalog containing dimensional information on hydraulic reservoirs and complete line of power unit accessories.

CENTURY HYDRAULICS, INC.
7703 LYNDON AVE. • DETROIT 38, MICHIGAN
Telephone: Diamond 1-3797

New Fluid Feed AIR-HYDRAULIC DRILL PRESS FEED!

Combines **Steady Even Hydraulic Control with Economical Dependable Air Power!**

with *Predictable* Speed Control

Learn how Mead's new oil-flow principle adjusts feed rate accurately 2 to 60 inches per minute—other superior features. Write factory or nearest Mead Man for folder plus Catalog of Mead units suitable for automation with it!

MEAD
SPECIALTIES COMPANY
4114 Knox Avenue, Dept. AH-38
CHICAGO 41, ILLINOIS

PATHFINDER IN AIR POWER AUTOMATION

CIRCLE 27 ON READER SERVICE CARD

CIRCLE 83 ON READER SERVICE CARD

NEW PRODUCTS

1/16 or ⅛ inch diameter and connections are ⅛ and ¼ inch NPT. Standard on all valves is a lock nut for panel mounting.

Specifications: Maximum operating pressure for brass and 316

stainless steel valves is 3000 psi. Temperature limits for brass valves —40 to 200 deg F; for stainless steel valves —60 to 450 deg F. Packing in brass valves is Buna-n O-ring and in the stainless valve, Teflon.

Hoke, Incorporated
Englewood, New Jersey

CIRCLE 321 ON READER SERVICE CARD

AIR COMPRESSOR
. . . for general industrial use

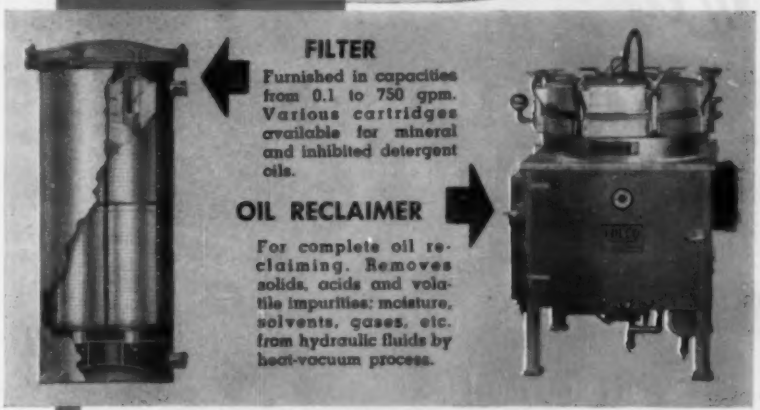
Designation: Hydrovane

Features: These rotary air compressors are said to be free from

vibration and extremely quiet. Units are completely enclosed and available with either horizontal or verticle tank mountings. There are no belts or couplings.

Continued on next page

For SUPER Finishes
you need
SUPER Filtration...



FILTER
Furnished in capacities from 0.1 to 750 gpm. Various cartridges available for mineral and inhibited detergent oils.

OIL RECLAIMER
For complete oil reclaiming. Removes solids, acids and volatile impurities: moisture, solvents, gases, etc. from hydraulic fluids by heat-vacuum process.

That's what you get with
HILCO HYDRAULIC OIL FILTERS

You get complete maintenance of all hydraulic fluids. That means increased production, reduced maintenance cost, reduced oil cost and continuous equipment protection. Only HILCO offers such a wide range of filters and systems engineered for your needs.

Write today for HILCO Bulletin F-132

HILCO CUTS COSTS BECAUSE IT ELIMINATES...
√ VARNISH AND SLUDGE DEPOSITS
√ FLUSHING AND MANUAL CLEANING
√ FREQUENT OIL CHANGES
√ ACCUMULATION OF DIRT

THE HILLIARD CORPORATION
148 W. FOURTH ST. • ELMIRA, NEW YORK

• IN CANADA •
UPTON-BRADEEN-JAMES, LTD.
890 YONGE STREET, TORONTO 8760 VERVILLE STREET, MONTREAL

CIRCLE 60 ON READER SERVICE CARD

NEW PRODUCTS

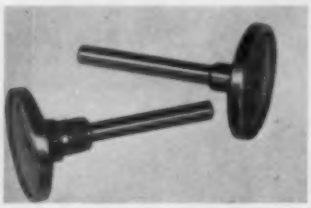
Specifications: Units are available in 2, 3 and 5 hp models and operate at 100 and 200 psi. Modulation, start-stop or combination modulation and start-stop unloading mechanisms can be furnished.

Davey Compressor Co.
Kent, Ohio

CIRCLE 322 ON READER SERVICE CARD

DIAL TYPE THERMOMETER
. . . designed for limited space

Designation: Model G



Features: With a head diameter of 1-11/16 inches the thermometer fits where mounting space is limited. The indicator is driven by a bi-metal coil which eliminates gears and linkages. Constructed entirely of stainless steel, all models are moisture sealed, overheat protected, pressure proof and individually calibrated.

Specifications: Available in eleven ranges from —40 to 1000 deg F and from —10 to 300 deg. C. The Model G can be supplied with stem lengths from 2½ to 72 inches.

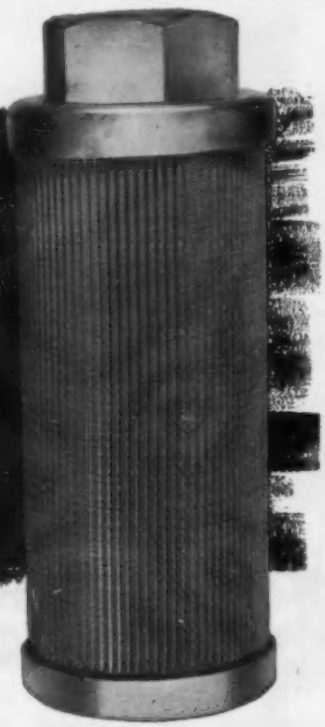
W. C. Dillon & Co., Inc.
Van Nuys, California

CIRCLE 323 ON READER SERVICE CARD

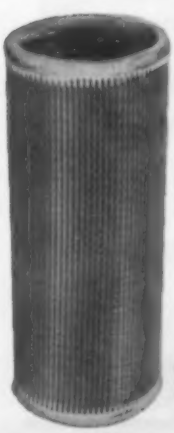
Capital

HYDRAULIC OIL FILTER with Monel Metal Insert

Reservoir Type for Hydraulic and Oil Re-circulating Machinery



EASY TO INSTALL—EASY TO CLEAN
LONG LIFE—LOW COST—SIZES AND SCREENS TO FIT YOUR NEEDS



★ ONLY THREE PARTS
★ MEETS J.I.C. STANDARDS
★ GREATER FILTERING AREA
★ SPECIAL TRAP-WEAVE MESH

Specially woven MONEL wire cloth and a new method of compact corrugation, gives triple protection with less space than other filters of like capacity. Trap-weave mesh stops thin, elongated particles with NO loss of efficiency.

Non-corrosive, non-toxic materials throughout. Easily cleaned with an ordinary brush.

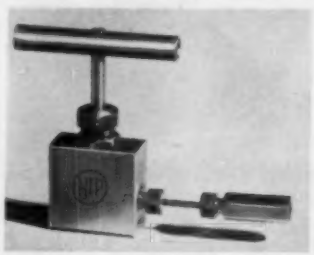
Write for descriptive circular.

CAPITAL ENGINEERING & MFG. CORP.

5836 SOUTH ASHLAND AVENUE, CHICAGO 36, ILLINOIS

MINIATURE VALVE
. . . for high pressures

Features: Designed for 1/16 inch tubing with operating pressures to



15,000 psi. Valve is available in stainless steel, Monel, and Hastalloy. Adaptable for compression, socket weld and IPS connections.

High Pressure Equipment Co., Inc.
Erie, Pennsylvania

CIRCLE 324 ON READER SERVICE CARD

VANE PUMP
. . . for power steering

Designation: Series V 200

Features: Vane type pump specially adapted for power steering systems on trucks with heavy front axle loading. Integral flow control and pressure relief avoids need for

extra valve unit. Nominal rated capacities are 5,8 and 11 gpm at 1200 rpm. Pump has maximum speed of

2200 rpm. All sizes are available with controlled flow rates of 2,4, 6 and 7 gpm at relief valve settings of 750 or 1000 psi.

Vickers Incorporated
Detroit 32, Michigan.

CIRCLE 325 ON READER SERVICE CARD

PRESSURE TRANSMITTER . . . for low cost remote indicating

Designation: Compu-Tran

Features: Low cost pressure to resistance transducer has many applications in the control of fluid power devices. It permits pressure information to be transmitted to

remote locations. Pressure points can be placed under supervisory control using conventional millivolt instruments. Used on hydraulic and pneumatic applications.

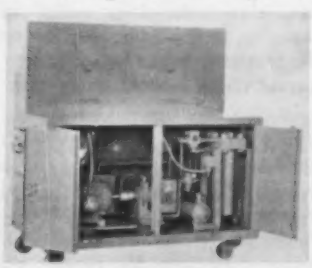
Specifications: Available in nine ranges from 15 to 3000 psi. Accuracy 1%.

International Resistance Co.
Philadelphia, Pennsylvania

CIRCLE 326 ON READER SERVICE CARD

HYDRAULIC TEST STAND . . . tests components at 275 deg F

Features: Equipment includes a variable volume piston pump for pressures up to 3000 psi. Instruments are provided for pressure

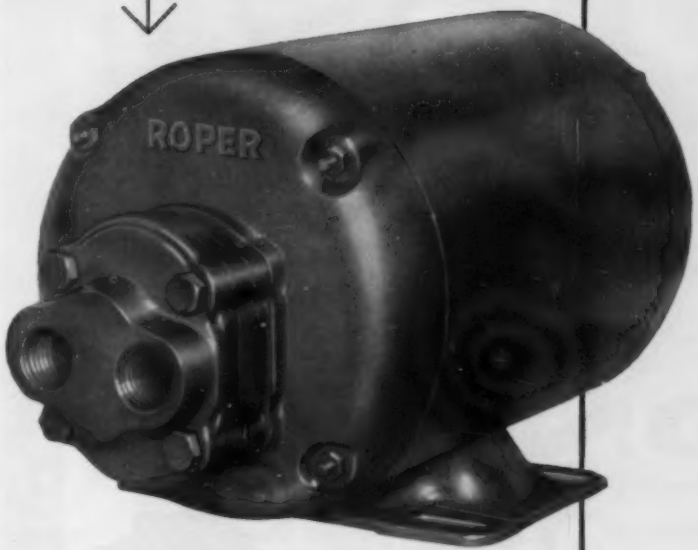


and flow measurements. A filtration system is incorporated for removing all particles down to 10 microns. A heating and cooling system with controls is also furnished.

J. N. Fauver Company
Detroit, Michigan

CIRCLE 327 ON READER SERVICE CARD

NEW



ROPER

T-SERIES PUMP UNIT

Compact, Integral Construction

.6 to 6.8 GPM — Pressures to 400 PSI

for Hydraulic, Pressure Feed, or Transfer Work

Space-savers for those stationary or mobile units where dependable pumping is a must. That's the new T Series by Roper . . . the compact pump unit that is approximately the same size as a standard motor of HP required for driving. The pump serves as the end bell of the motor . . . design eliminates a coupling, thus conserving valuable space. Look into it now — it can well solve some of your pumping problems.

✓ **PUMP HOUSING** — High density cast alloy iron. Single piece back plate serves as end bell of motor.

✓ **PORTS** — ½" NPT in faceplate for convenient connections.

✓ **GEARS** — Fatigue-proof steel spur gears run in axial hydraulic balance.

✓ **BEARING** — Heavy duty bronze assures accurate alignment of elements.

✓ **SEAL** — Lip type, with pressure relief system built-in to maintain zero pressure in seal chamber.

✓ **MOTORS** — Single phase, 60 cycle (standard) . . . open drip-proof or totally-enclosed. ¾ to 1 HP — single or dual voltage depending on size or need.

See this pump at
BOOTH 423
Design Engineering Show

703 BLACKHAWK PARK AVE.

ROCKFORD, ILLINOIS

ROPER
HYDRAULICS, INC.

CIRCLE 106 ON READER SERVICE CARD

One source for component parts really pays off... coordinated shipments, the same high quality standards, one responsibility are just a few of the many advantages. H-P-M is the source for a complete line of pumps, power units, valves, cylinders and system accessories. H-P-M's experience background in the design and building of hydraulic systems can be a real help when needed. Write today for a complete catalog. Ask for Bulletin 1101. Make H-P-M your standard for savings.

H826

HPM

HYDRAULIC POWER DIVISION
THE HYDRAULIC PRESS MFG. COMPANY
A DIVISION OF KOEHRING COMPANY • MOUNT GILEAD, OHIO, U. S. A.

CIRCLE 65 ON READER SERVICE CARD

USEFUL LITERATURE

INTENSIFIERS FOR PRESSURE TESTING . . . use 90 psi shop air to develop outputs of up to 23,000 psi oil or 10,000 psi water, and weigh less than 80 lbs. Both models are readily portable, intended for testing boilers, piping, compressor cylinders, lab destruction tests, etc. A brochure from *Cooper-Bessemer Corp., Mount Vernon, Ohio,* describes the units.

CIRCLE 410 ON READER SERVICE CARD

TEMPERATURE CONTROL VALVES . . . that use the sliding-gate valve principle are outlined in Bulletin J-180, *Jordon Industrial Sales Division of OPW Corporation, Cincinnati, Ohio.* Information gives: sizing charts, dimensional drawings, control specifications, material specifications and accessory item list.

CIRCLE 411 ON READER SERVICE CARD

FLEXIBLE COUPLINGS . . . of "press on", three-piece design, "Magnaloy" couplings use superlight magnesium alloy with neoprene drive insert. The units may be installed and removed by hand and locked in place with an Allen wrench. A brochure released by *Detroit Power Coupling Co. Detroit,* lists specifications, ratings and dimensions of available models.

CIRCLE 412 ON READER SERVICE CARD

INDUSTRIAL HOSE . . . couplings, stems, swivels and accessories are listed in the 32 page catalog of *J. N. Fauver Co., Detroit, Michigan.* Also included is useful information relating to application, selection and mounting of hose.

CIRCLE 413 ON READER SERVICE CARD

HYDRAULIC PACKINGS . . . "V"-type, fabricated by *E. F. Houghton & Co., Philadelphia, Pa.* are featured in a new 4 page folder. The folder lists the number of leather, homogeneous rubber and fabricated rubber "V's" which should be used under various operating pressures, and outlines the use of male and female adapters with "V" sets. A complete listing of Houghton Standard "V" sizes is included.

CIRCLE 414 ON READER SERVICE CARD

PNEUMATIC CYLINDERS . . . manufactured by *Westinghouse Air Brake Co., Wilmerding, Pa.* are described in catalog D3-41.01. Information relating to diameter and lever selection is included in addition to mounting and installation dimensions.

CIRCLE 415 ON READER SERVICE CARD

PLASTIC GASKET & SHIM STOCK . . . has a double identification feature to speed selection. Six basic gauges are identified by color and by gauge number printed in an over-all pattern. The stock is impervious to oil and water, dimensionally stable and withstands 400 F. Bulletin No. 570 issued by *Chicago-Wilcox Mfg. Co., Chicago, Ill.*, gives detailed information on the material.

CIRCLE 416 ON READER SERVICE CARD

RELIEF VALVES . . . spring actuated and adjustable may be selected in catalog 110 of *Tuthill Pump Co., Chicago, Illinois.* The catalog includes performance curves, complete dimensions, cutaway drawings and photographs of the valves.

CIRCLE 417 ON READER SERVICE CARD

FLUID POWER VALVES . . . in a wide variety of valve-type are the subject of the 58-59 Catalog of the *Barksdale Valves, Los Angeles, California.* The valves listed include: four-way, three-way, shut-off and diverter flow patterns, manual and solenoid. Also included are sections on charts for determing pressure drop and discharge velocities and pressure conversions. A further section summarizes the probable causes and remedies for the more difficult maintenance problems, with comprehensive maintenance suggestions.

CIRCLE 418 ON READER SERVICE CARD

CENTRALIZED LUBRICATION . . . is covered in bulletin 34-28 offered by *Alemite Div. of Stewart-Warner Corp., Chicago, Illinois.* Schematic diagrams of machine lubricating systems, manual and automatic, are given with a listing and description of system components. Supplement 34-28A presents system planning data for the analysis, selection and installation of lubrication systems.

CIRCLE 419 ON READER SERVICE CARD

Continued on next page

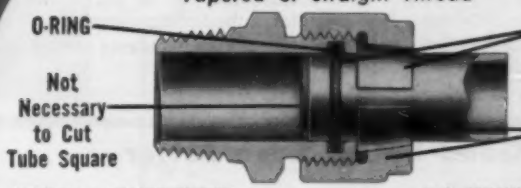
A TOP NAME IN THE INDUSTRY

LENZ COMPANY

A Complete Line of Fittings and Connections for any Type of Rising Application . . .

Featuring LENZ O-RING TUBE FITTINGS

Tapered or Straight Thread



PATENTED • PATENTS PENDING J.I.C. APPROVED

NO METAL TO METAL SEAL!

NO EXACT TUBE LENGTH NECESSARY!

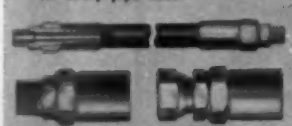
Lenz fittings seal with standard, stock O-Rings. At zero pressure the initial compression furnishes necessary sealing force . . . the higher the pressure the tighter the seal. Every joint becomes a union!

LENZ FITTINGS pay for themselves over and over again by reducing installation and maintenance costs... only a hacksaw and a file needed... no periodic tightening... remain leakproof and reusable no matter how often reassembled... Ideal for all tubing on hydraulic, air or vacuum systems.

New LENZ PRODUCTS

PIPE FITTINGS

A complete line of connectors, elbows, crosses, tees, bushings, couplings, nipples and plugs . . . for every pipe need.

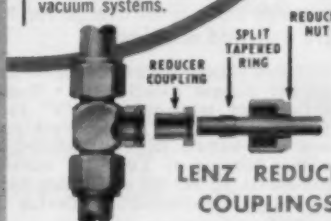


HOSE FITTINGS

Perfectly matched hose assemblies . . . a full line of re-usable fittings and hose lengths in low, medium and high pressure ranges.

AIR BLEEDER VALVES

Compact, functional . . . only two metal parts . . . no packings. Maintain maximum operating efficiency by eliminating air from lines.



LENZ REDUCER COUPLINGS

Makes possible line reductions on any leg by use of standard adapters and adapter nuts. Eliminates large inventory of special fittings and possibility of obsolesence from engineering changes. Full range of sizes.

OTHER LENZ PRODUCTS

In addition Lenz manufactures and supplies a full range of sizes in HYDRAULIC TUBING . . . INDUSTRIAL HOSE . . . STEMS and JOINERS . . . DEBURRING CUTTERS . . . TUBE CUTTERS . . . and TUBE BENDERS. See our ad in Thomas Register, under Fittings: Hydraulic, for complete listing.

Free! Write For newly released LENZ catalogs for complete product line and sizes on above products . . . Ask to be put on our mailing list.

Representatives In Principal Cities

LENZ COMPANY

3303 Klepinger Road
DAYTON 1 • OHIO
Phone: CRestview 7-9364

CIRCLE 74 ON READER SERVICE CARD

USEFUL LITERATURE

CORROSION RESISTANCE . . . A revised edition of "Corrosion Resistance of Copper and Copper Alloys," a 32-page reference booklet, has been released by *American Brass Co., Waterbury, Conn.* The new edition incorporates the company's latest findings from laboratory research and field study of the nature of corrosive attack on these metals. Tables indicate the relative corrosion resistance of the principal types of copper and copper base alloys when in contact with 186 different corroding agents.

CIRCLE 420 ON READER SERVICE CARD

INDUSTRIAL HYDRAULIC FITTING . . . circular is available from *AFCO Fitting Co., Cleveland, Ohio.* It presents pictures of the complete line of flared and flareless tube-fitting assemblies.

CIRCLE 421 ON READER SERVICE CARD

Make Good Design Even Better . . .

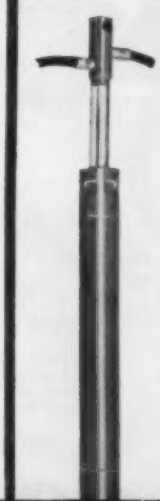
BHEW Made-to-Order HYDRAULIC CYLINDERS

Whatever your cylinder requirements, you're sure of dependable operational performance with efficient, close-tolerance BHEW cylinders that require minimum mounting space. Built to meet your specifications, their cost is reasonable; there is no charge for tooling; they are delivered on schedule.

BHEW CYLINDER FEATURES: • Standard and special designs available. • Double or single acting and telescopic. • 1½" to 8" bore. • Strokes up to 156". • Smallest possible O. D. and retracted O. A. length. • Oil cylinders with 1,500 psi or 3,000 psi working pressure, pneumatic up to 150 psi. • Cup-type, ring-type or O-ring construction. • Choice of mounting.

Double-Acting 2-piece Piston Rod Cylinder. It is excellent for extending and retracting boom arm. Both hoses are connected on rod end. →

1. Hinged mount for alignment.
2. Honed steel cylinder.



WRITE for your copy of Hydraulic Cylinder Engineering Reference Data Manual. Can save you hours of time in specifying cylinders. 40 dimensioned basic designs for general and special purpose double acting cylinders.

BHEW BENTON HARBOR ENGINEERING WORKS, Inc.

622 LANGLEY AVENUE, ST. JOSEPH, MICHIGAN

SHAFT COUPLING . . . engineering data is given in Bulletin No. 10100 from *T. B. Wood's Son's Co., Chambersburg, Pa.* The bulletin describes Wood's flexible couplings. Tables are given for the selection of couplings, taking into consideration the type of driver, horsepower and rpm, as well as the specific application.

CIRCLE 422 ON READER SERVICE CARD

COMPRESSED AIR GUIDE . . . is available from *C. A. Norgen Co., Englewood, California* in a 4 page brochure entitled "You Benefit by Proper Compressed Air Processing" The factors discussed are: filtration, operating pressure, lubrication and line installation. Should be of interest to every compressed air user.

CIRCLE 423 ON READER SERVICE CARD

SHAFT SEALS . . . for rotating shafts are described in a booklet titled "Solving The Problem of Seals for Rotary Shafts" offered by *Muskegon Piston Ring Co., Sparta, Michigan.* Seals discussed are of the mechanical type. Several methods of seal installation are shown with the aid of a transparent overlay.

CIRCLE 424 ON READER SERVICE CARD

ENGINEERING DATA . . . useful to hydraulic engineers and designers is contained in a 40 page bulletin that has been published by *Hamilton Division, B-L-H, Hamilton, Ohio.* Extensive coverage includes: hydraulic ram capacities accumulator capacities, fluid losses, water hammer formulae, strength of materials, beam formulae and numerous mechanical tables.

CIRCLE 425 ON READER SERVICE CARD

AIR CYLINDERS . . . with integral solenoid valves are described in a circular offered by the *A. K. Allen Co.,* Brooklyn, New York. Mounting dimensions are tabulated. Full scale lay-out templates are also available.

CIRCLE 426 ON READER SERVICE CARD

PUMP MOTORS . . . from ⅛ to 1000 hp are discussed in a four page bulletin B-2507 offered by *Reliance Electric and Engineering Co., Cleveland, Ohio.* The bulletin describes the Reliance Partial Motor concept for attaching the machined motor frame directly to a pump frame to form an integral unit.

CIRCLE 427 ON READER SERVICE CARD

CIRCLE 64 ON READER SERVICE CARD

THE ORIGINAL
MONOPAK—CARTRIDGE

A complete packing unit for hydraulic or pneumatic rods or cylinders.

- Easily installed or replaced.
- Needs no adjusting.
- Reduces initial machining expense.
- Longer service life.
- Includes "Seal-Guard" rod wiper.
- Low friction coefficient.
- Shock and burst proof.
- Cuts machine down-time.

*Detailed literature on request.

HYDRAULIC ACCESSORIES CO.
24301 Hoover Rd. Van Dyke, Mich.

CIRCLE 128 ON READER SERVICE CARD

TRU-O-SEAL STOPS PIPE THREAD LEAKS

PAT. PENDING

Satisfaction Guaranteed Or Money Back TRIAL OFFER

TRU-O-SEAL Fittings are guaranteed to seal pipe thread connections permanently against all oils, practically all known chemicals and gases; to seal under high pressures or vacuum; to withstand —280° to plus 500° F.; to eliminate "overtightening" damage and pipe dope. Available in ⅛" to 2½" pipe thread sizes.

$10.00 Trial Offer No. 1: eight ⅛", ten ¼", eight ⅜", ten ½" pipe thread TRU-O-SEAL Fittings.

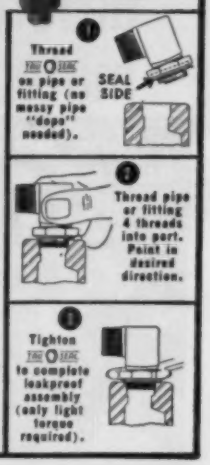
$10.00 Trial Offer No. 2: eight ½", ten ¾", four 1" pipe thread TRU-O-SEAL Fittings.

Send order to

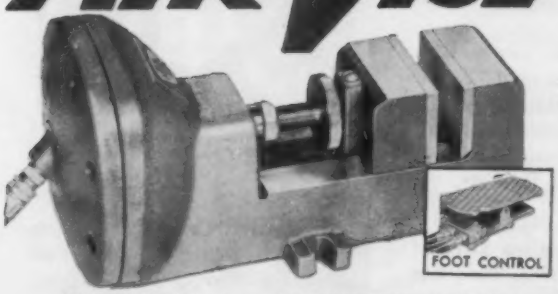
TRU-O-SEAL DIVISION
Flick-Reedy Corp

2008 N. Hawthorne, Melrose Park, Ill.

"Miller Fluid Power" is also a Div. of Flick-Reedy Corp.


1
Thread TRU-O-SEAL on pipe or fitting (no messy pipe "dope" needed).
SEAL SIDE
2
Thread pipe or fitting 4 threads into port. Point in desired direction.
3
Tighten TRU-O-SEAL to complete leakproof assembly (only light torque required).

Speedy
AIR VISE



HIGH SPEED • POWERFUL GRIP

New, improved model speeds up all repeat operations—*milling, drilling, tapping, punching, bending, riveting.* Both hands left free to produce more! Light squeeze to 2250 pounds pressure! Extra thick jaws for attaching jigs. Jaws open to 3-inches; 1/16" to 5/8" maximum travel. Complete with foot control, air hose and fittings..... **$44.00**

SPEEDY 1-TON AIR PRESS
Does the work of expensive presses! Power factor 15 times air line pressure. 5-inch throat; Ram 0 to 5"; stroke ⅜"; table 5" x 5". Operated by foot or fingertip controls. **$85.00**

Order from Your Supplier or Write for Air Tool Catalog

W. R. BROWN CORP., 2655 N. Normandy Ave., Chicago 35

AIR TOOLS • AIR VISES • AIR REGULATORS • FILTERS • COMPRESSORS

2568

REMOVE MOISTURE from

COMPRESSED AIR LINES

Air operated tools, instruments and controls demand air that is

COOL
CLEAN
& DRY

and the

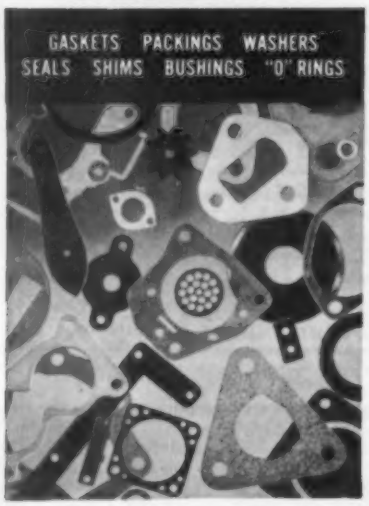
MURPHY AFTERCOOLER SYSTEM
GUARANTEES IT!

Write now for FREE Data Sheet No. 2568.

JAMCO

JAS. A. MURPHY & CO., INC.
1417 EAST HIGH STREET, HAMILTON, OHIO

We fabricate in more than 200 different materials*



If it's a problem of the right material for the job—at the right price—Auburn is sure to have the perfect solution among the wide range of materials in which we work.

Put our 87 years experience to work for you—Auburn's engineers are tops in their field in designing and fabricating precision sealing devices. Their know-how is at your command. "O" Rings are a speciality with us.

*Leather • Asbestos • Nylon • Vinyl • Teflon
Silicone Rubber • Neoprene • Rubber • Cork
Fibre • Compositions • Phenolics • Cloth • Felt
Paper • Cardboard • Plastics • Brass • Steel
Copper • Aluminum • Kel-F
Other Special Materials

Send us your specifications or blueprints. You'll receive prompt quotations and recommendations without obligations.

AUBURN
MANUFACTURING COMPANY
308 Stack St., Middletown, Conn.

New York, N. Y.; Rochester, N. Y.; Detroit, Mich.; Chicago, Ill.; Minneapolis, Minn., Pittsburgh, Pa.; Cincinnati, Ohio; Ridgewood, N. J.; Atlanta, Ga.; Memphis, Tenn.; St. Louis, Mo.; Camden, N. J.; Washington, D. C.

CIRCLE 14 ON READER SERVICE CARD

POST SCRIPTS OF INDUSTRY

News about people, manufacturers and sales organizations

Walter Kudlaty has been promoted to chief design engineer for the **Miller Fluid Power** and **Tru-Seal Divisions** of **Flick-Reedy Corp.**, with responsibility for product design and research. Kudlaty is a member of the technical board of NFPA.

Walter Kudlaty
Flick-Reedy Corp.

Roy Golze
Vickers Inc.

Vickers Inc., Detroit, has appointed **Roy Golze** as district manager in the Philadelphia area. Golze was formerly an application engineer working from the Vickers New York area office.

In an expansion move, **Gits Bros. Mfg. Co.** has established a **Pneumatics Division,** specializing in air line lubrication. Heading the new setup are **Alvin J. Dunn** and **Gerald B. Gits.**

Buffalo Hydraulics Div. of **Houdaille Industries, Inc.,** has announced two promotions at the Delavan Ave. plant in Buffalo. **James P. Jennings** was named factory manager and **Ralph A. Braaten** has moved into Jenning's vacated post as superintendent of standards.

The Fuller Co., Catasauqua, Pa., has announced the appointment of Robert F. Miller as advertising manager. Miller replaces **Russell Hawk,** who retired after 22 years with the company.

Automatic Switch Co., Florham Park, New Jersey, has announced the appointment of the following companies as stocking distributors of ASCO solenoid valves: **Sterns Electric Equipment Co.,** 66 Broadway, Buffalo 3, New York; **Fischer Industrial Equipment Co.,** 6851 Plainfield Rd., Cincinnati 36, Ohio; **Butler and Land,** 5538 Dyer St., Dallas 6, Texas.

George E. Carlson has been elected chairman of the board of directors of **Minnesota Rubber Co.,** Minneapolis. **Robert W. Carlson,** formerly vice president and general manager, succeeds him as president.

George E. Carlson
Minnesota Rubber Co.

Robert W. Carlson
Minnesota Rubber Co.

Hannifin Crown Products Div., a subsidiary of **Parker-Hannifin Corp.,** Des Plaines, Ill., has announced the appointment of **Louis H. Hein Co.,** Ardmore, Pa., Jersey City, N. J., and Baltimore, Md., as distributors of the of the Hannifin Crown line of compressed air filters, regulators and lubricators.

Jack Neun has been named manager of the Seattle, Washington, office of **Hydraulic & Air Equipment Co.,** Portland, Ore. He will be active in the sales of

hydraulic equipment manufactured by Racine Hydraulics & Machinery, Inc., Racine, Wis. Neun formerly was sales manager for Ross Operating Valve Co., Detroit.

Promotion of three employees at **C. A. Norgren Co.** has been announced. **Edward H. Roos** has been made vice president in charge of engineering, production and purchasing; suceeding Roos as factory manager is **Richard L. Beach. James A. Machen** has been appointed plant superintendent, a new position in the manufacturing division of the firm.

Edward H. Roos
C. A. Norgren Co.

William W. Burke
Modernair Corp.

William W. Burke has been named general manager of **Modernair Corp.**, San Leandro, Calif. Burke has headed Modernair's sales department for the past four years.

Ted Wietke has joined the **J. N. Fauver Co.**, Detroit, as an industrial sales engineer. Wietke takes over the western Michigan territory previously handled by **Frank O'Donnell,** now a technical sales and service engineer in the Fluid Power Division.

Ted Wietke
J. N. Fauver Co.

Kenneth F. Sigler
Alta Engineering Co.

Alta Engineering Co., Denver, has announced the appointment of **Kenneth F. Sigler** to its field engineering force. Alta sells hydraulic and pneumatic components in the Rocky Mountain states.

Continued on next page

PHOTO COURTESY HUGHES AIRCRAFT COMPANY, CULVER CITY, CAL.

Eagle HYS Series Timer with Time Delay Feature

EAGLE SIGNAL engineers unique timer for Hughes airborne armament control system

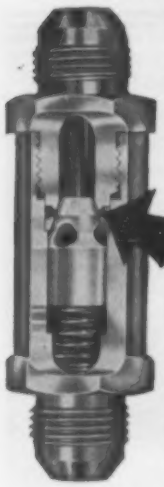
A new electro-mechanical time delay device has been developed by the Eagle Signal Corporation for the Hughes Aircraft Company. Hughes uses the Eagle timer in an armament control system the company builds for the supersonic F-102A all-weather interceptor.

The Eagle timer is a hermetically sealed unit, actuated by a 28-volt d-c solenoid. The timer has been built to provide a delay in application of power to load circuit at the end of a timing interval. A rotary solenoid winds a spring on the escapement mechanism, and timing begins when the solenoid is energized. The Eagle timer operates under rigorous environmental conditions, and is built to withstand extra heavy duty applications.

Development of this special Eagle timer is just one example of the electronic and aeronautical engineering "know-how" to be found at Eagle Signal. Consult Eagle Signal on your timing and counting problems *early in your planning.* And write for Bulletin 820 for more information on the escapement timer. Eagle Signal Corporation, Dept. AH-358, Moline, Illinois.

CIRCLE 41 ON READER SERVICE CARD

CIRCLE 70 ON READER SERVICE CARD



Simple, Secure
. . . Leak-Tight!
this
FLEXIBLE
SEAL
SEAT*

Here's the secret . . . responsive action of the soft, long-lasting O-ring seal! Instantly compresses to seal internal and external pressures. Draws harmlessly around dirt particles. No costly precision parts or extra end seals. Six standard Dryseal pipe and JIC tube sizes: 12 connection combinations. Send for data sheet.

KEPNER PRODUCTS COMPANY
7321 West 59th Street • Summit, Illinois

Kep-O-seal
HYDRAULIC & PNEUMATIC
CHECK VALVES
* PATENT APPLIED FOR

POST SCRIPTS OF INDUSTRY

John R. Partin has been named as sales engineer for the Philadelphia district by **Askania Regulator Co.**, a subsidiary of **General Precision Equipment Corp.**

R. H. "Rod" Spann has been promoted to field engineer in the Indianapolis district office of **National Seal Div., Federal-Mogul-Bower Bearings, Inc.** Territory is Indiana, southern Ohio, Kentucky and Tennessee.

The Industrial Silencer Division of the Burgess-Manning Company has moved to a new plant at 9207 Soverign Row, Dallas, Texas.

Alta Engineering Company have moved to their new building, comprising offices and warehouse, at 2950 South Fox Street, Englewood, Colorado. The company, headed by **Paul Locklin,** specializes in the sale of hydraulic and pneumatic components throughout the Rocky Mountain area.

MARSHALLTOWN

THE RIGHT GAUGE
FOR YOUR
SPECIFIC NEEDS

Available in a wide variety of general purpose and special purpose gauges in pressure ranges to meet your specifications in every particular.

- PRESSURE
- VACUUM
- COMPOUND
- ALTITUDE
- COMBINATION
- DIAPHRAGM
- HYDRAULIC
- AND SPECIAL PURPOSE GAUGES
- DIAL THERMOMETERS (Vapor Tension or Bi-Metal)

WRITE TODAY FOR COMPLETE INFORMATION

MARSHALLTOWN MFG. COMPANY
MARSHALLTOWN 4, IOWA

HP

HYDRAULICS &
PNEUMATICS LTD
Proudly present—

- VACUUM PUMPS AND COMPRESSORS FOR VEHICLE BRAKING,
- POWER ASSISTED STEERING,
- INDUSTRIAL HYDRAULICS,
- INDUSTRIAL PNEUMATICS.

We are interested in appointing distributors in all countries.

LICENCEES FOR MODERNAIR IN EUROPE

HYDRAULICS & PNEUMATICS LTD
A MEMBER OF THE TURNER MANUFACTURING CO. LTD. GROUP OF COMPANIES
WULFRUNA WORKS • VILLIERS ST.
WOLVERHAMPTON • ENGLAND

CIRCLE 81 ON READER SERVICE CARD

CIRCLE 66 ON READER SERVICE CARD

Byron Jackson Pumps, Inc. a subsidiary of **Borg-Warner Corp.,** has opened a new district office in Birmingham, Alabama. Located at 2031 Ninth Ave. South, the new office is under the direction of **E. J. Dailey,** and offers sales and application assistance on the company's line of centrifugal pumps.

Robert K. Rockwell has been named marketing manager of **Sealol Corp.**

Edward H. Fisher has been elected president of **Tube Reducing Corp.,** Wallington, N. J. Fisher was previously vice president and manager of the Special Products Div. of Oliver Corp., Chicago.

Edward H. Fisher
Tube Reducing Corp.

William Hartranft
Garlock Packing Co.

Howard W. Brandt
Kalamazoo Div.
New York Air Brake Co.

Garlock Packing Co., Palmyra, New York, has announced these assignments: **William Hartranft** has been named product manager of the company's gasket line. Hartranft was formerly a field representative in the Mechanical Seal Department. **James H. Munger** has taken over a new sales territory covering southern Michigan, northern Indiana and parts of northern Ohio.

The appointment of **Howard W. Brandt** as general manager of the **Kalamazoo Div., New York Air Brake Co.,** has been announced by Charles T. Zaoral, president.

UCON

BRAND

HYDROLUBES

HELP

PROTECTION The fire-resistance of CARBIDE's fire-resistant hydraulic fluids has been proved by severe, exhaustive laboratory tests. And, in actual service, water-base UCON hydrolubes have prevented serious fires and injuries during more than 10 years of routine use in all types of industrial hydraulic equipment. The common fire hazards connected with hydraulic operations are eliminated when UCON hydrolubes are used. UCON hydrolubes are classified as acceptable, less hazardous fluids by Factory Mutual Laboratories.

ECONOMY UCON hydrolubes 150-CP and 275-CP are the economical answer to fire-resistance in hydraulic fluids. Most commercial hydraulic equipment can be easily converted to UCON hydrolubes with a minimum of time and expense. UCON hydrolubes have no harmful effects on most packings or seals. In fact, in many instances, reduced leakage losses have been reported. UCON hydrolubes also provide maximum protection against liquid and vapor phase corrosion and have outstanding anti-wear characteristics—thus, pump replacement costs are also held to a minimum.

Why not get all the facts on how UCON hydrolubes can mean protection plus economy for you. Write today for the booklet, "UCON Hydrolubes Spell Safety," F-40134.

UNION CARBIDE CHEMICALS COMPANY

Division of UNION CARBIDE Corporation

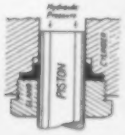
30 East 42nd Street, New York 17, N. Y.

"Ucon" is a registered trade-mark of UCC.

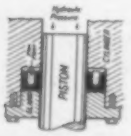
Page...

a dependable source for mechanical packings

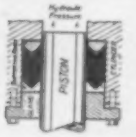
Cup packing



Flange packing



"U" packing



"V" packing

Available with permanent type impregnants for temperatures to 225° F.

When you have exacting specifications to meet . . . plus a budget to watch . . . it will pay you to check with Page. You'll get the right packings fast . . . including packings with permanent type impregnants for temperatures from —65° F. to 225° F. . . . and benefit from the engineering know-how and complete facilities of an organization with nearly a century of experience.

You'll find a complete line of U's, V's, Cups and Flanges, made from various leathers with special impregnations to meet a wide range of applications. Standard synthetic packings also available.

Specify Page Packings. You'll get complete cooperation and a dependable source of supply. Write for your copy of the Page Packing Manual.

PAGE BELTING CO.
trademark

PAGE BELTING COMPANY
established 1868

Concord — New Hampshire
Page Packings — engineered to do a better job

MARKET PLACE

When replying to a box number in the Market Place, address your letter to Applied Hydraulics, 812 Huron Road, Cleveland 15, Ohio. Attention: Box No.

SALES MANAGER

Aggressive young company specializing in the industrial application of hydraulic accumulator and control systems has opening for a man with a mechanical engineering background to handle sales and development work. Please furnish full details of previous training, experience and a recent photograph with your letter of application. Home Office—New Orleans. Write to Box 3258 APPLIED HYDRAULICS.

INDUSTRIAL SALES MANAGEMENT EXECUTIVE

Opportunity for top-flight man is being created by growth of well-established midwest firm selling through industrial supply and construction equipment distributors and electrical wholesalers. Experience with hydraulic equipment and sales direction of products sold through distributors is desired. Engineering background will be helpful. Attractive, wholesome area for family life.
Because prior inquiries may have been lost in a mail relay, previous respondents are urged to again write Box 3158, APPLIED HYDRAULICS.

MANUFACTURER'S REPRESENTATIVES WANTED

Manufacturer of hydraulic equipment in aircraft and missile fields now ready to market low cost industrial designs on patented items. Products have applications in many industries. No competition. Nationally advertised. Exclusive territories available throughout the country for experienced, aggressive men or companies. Mail complete details on background, territory covered and companies represented to address below. Later contacts will be made by company officer. All replies held in strict confidence. Write Box 3358, APPLIED HYDRAULICS.

HAVE YOU ANY SURPLUS FITTINGS FOR SALE?

We are interested in buying Hi-Compression Steel Fittings, primarily (W) WEATHERHEAD AND (I) IMPERIAL makes "ER" in "ERMETO" type, such as Nuts, Sleeves, Male and Female Connectors, Unions, 45 and 90 degree Male and Female Elbows, Male and Female Branch Tees, Tee Unions, Male and Female Run Tees, Bulkhead Unions, etc.
Please submit inventory lists or samples.

Hydro Fitting Sales Company
Dept. AH,
2027 S. Michigan Ave., Chicago 16, Ill.
CAlumet 5-2383

For Sale

2 Hydraulic Pump Test Units (complete) with flow meters, instruments, etc.
Call 6-1736 ..... BRYAN, OHIO

Advertisers' Index

March 1958

Ace Products Company 140
R. P. Adams Co., Inc. 111
Adel Precision Products Division, General Metals Corp. 50
Air-Mite Devices, Inc. 156
Alemite Division, Stewart-Warner Corp. 23
Allen Manufacturing Co. 128
Almo Tool Co. 109
American Hollow Boring Co. 133
American Standard, Ross Heat Exchanger Division 15
Anchor Coupling Co., Inc. 5
V. D. Anderson Co., Purifier Division 109
Arrow Tools, Inc. 134
Auburn Mfg. Co. 150
Auto-Diesel Piston Ring Co. 136
Automotive Products Co. Ltd. 132

Barco Manufacturing Co. 109
Barksdale Valves ..... Cover 3
Behlen Manufacturing Co. 45
Bellows Company 93
Benton Harbor Engineering Works 148
Briggs Filtration Co., Div. R. Brown Corp. 133
W. R. Brown Corp. 149
Buffalo Hydraulics Division, Houdaille Industries, Inc. 32

Capital Engineering & Mfg. Corp. 144
Cardwell Machine Co. 108
Century Hydraulics, Inc. 142
Chicago Rawhide Mfg. Co. 31
Chiksan Co. 28
Clippard Instrument Laboratory, Inc. 110
Commercial Filters Corp. 16
Commercial Shearing & Stamping Co. 81
Cross Mfg. Company 111
Cuno Engineering Corp. 24

Darling Valve & Mfg. Co. 44
Davey Compressor Co. 113
Denison Engineering Div., American Brake Shoe Co. 29
Detroit Coil Co. 8

Eagle Signal Corp. 151
Eastern Industries, Inc. 53
Eastman Mfg. Co. 21
Ex-Cell-O Corp., Rotac Division 107

Fluid Controls, Inc. 142
S. G. Frantz Co., Inc. 111
Fulflo Specialties Co., Inc. 40
Fuller Company 46

Gast Mfg. Corp. 90
Gits Bros. Mfg. Company 103
Goshen Rubber Co., Inc. 139
Graton & Knight Co. Inc. 38
Greene, Tweed Co. 113
Greer Hydraulics, Inc. 116
Gresen Mfg. Co. 110

Hall & Hall Ltd. 66
Hanna Engineering Works 1
Hansen Mfg. Co. ..... Cover 2
Helicoid Gage Division, American Chain & Cable 36
Hilliard Corp. 143
Hitchcock Publishing Co. 110
Houdaille Industries, Inc., Buffalo Hydraulics Division 32
E. F. Houghton & Co. 18, 19
C. B. Hunt & Son, Inc. 4
Hydraulic Accessories Co. 149
Hydraulic Power Division, Hydraulic Press Mfg. Co. 146
Hydraulics & Pneumatics Ltd. 152

James, Pond & Clark, Inc. 128
Johns-Manville 95

Kalamazoo Division, New York Air Brake Co. 17
Keelavite Rotary Pumps & Motors Ltd. 91
Kepner Products 152

L & L Manufacturing Co. 88
Benjamin Lassman & Son 67
Ledeen Mfg. Co. 14
Lenz Company 147
Lincoln Machine Co., Inc. 137
Linear, Inc. 47
Logansport Machine Co., Inc. 9

SEALOL

. . . DOES WHAT IT SAYS!

BALANCED PRESSURE SEALS

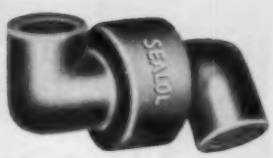
Pressures . . . to 1000 PSI
Temperatures . . . to 700° F
Speeds . . . (rubbing) to 15,000 FPM
Features . . . original "balanced pressure" design, compact, rotary-type fluid seal.
Request Bulletin 7/18.

ROTARY JOINTS

Pressures . . . to 150 PSI (steam); to 350 PSI (fluid) (also vacuum service).
Temperatures . . . to 425° F
Speeds . . . to 1750 RPM
Features . . . balanced pressure, low torque, leak-proof
Request Bulletin 14.

SWIVEL JOINTS

Pressures . . . to 3500 PSI.
Temperatures . . . to 350° F.
Features . . . for liquids, vapors, gases.
Request Bulletin 15.



CHECK VALVES

Pressures . . . to 3000 PSI.
Temperatures . . . from —65° F to +350° F.
Features . . . low pressure drop, full flow, positive checking.
Request Bulletin 16.

Free Literature . . . Send for complete data on any or all of these products . . . or ask for engineering recommendations. Write or phone today!

SEALOL

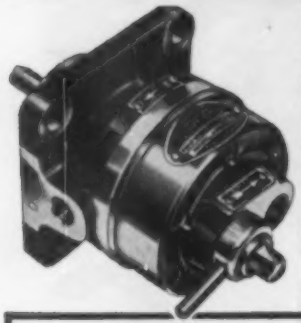
THE BALANCED PRESSURE SEAL

Representatives in principal cities

SEALOL CORP.
153 POST ROAD,
PROVIDENCE 5, R. I.

CIRCLE 110 ON READER SERVICE CARD

SAVERY ANNULAR PISTON PUMP



Infinitely variable from maximum output down to zero. Working pressures up to 1500 p.s.i. Fixed delivery models also available.

This compact rotary pump without Gears, Valves, Vanes or Springs is of unique design and simple in construction.

The pump has the following desirable characteristics:

- Volumetric efficiency as high as 99%
- Absolute positive action and steady uniform flow at slow speeds
- No aeration or turbulence of the fluid
- The path of the fluid through the pump is unidirectional and the internals are constantly swept by the fluid
- No idle pockets or passages to cause air locks or allow coagulation
- Completely self-lubricating, ensuring capacity to run for long periods without attention
- Leakproof

U. S. and CANADIAN AGENT
DAVIES BROS., GLADSTONE, NEW JERSEY

Thomas Savery Pumps Ltd., Birmingham, England

AIR-MITE

HIGH PRODUCTION AIR PRESS
with more Quality Features

★ **Solid Steel Column. Greater strength and rigidity.**
★ **Brass cylinder, aluminum end castings, Hy-Car piston cups.**
★ **Accurately ground table.**
★ **Fast set-up and stroke adjustment.**

You don't have to "baby" an AIR-MITE Press because they're ruggedly built to stand the gaff of production work. From the tip of their solid steel column to the heavy base, they're every inch a workhorse tool. Feature-for-feature, you can't buy a better, more economical operating press than an AIR-MITE.

Special adaptations available. Write us your needs.

1 Ton Capacity
$89.95
F.O.B. Chicago

New 3 Way Control Valve. For safer, more efficient press work, use AIR-MITE Control Valves. Connected in parallel and positioned on either side of an air press, they provide a safe, instantaneous press operating control. Operator must depress both handles to actuate press . . . keeps attention on work-piece, hands out of the way. For pressures up to 160 p.s.i.

AIR-MITE Devices, Inc.

4401 W. KINZIE ST., CHICAGO, ILLINOIS

ADVERTISERS' INDEX

Marsh, C. W. Corporation 131
Jas. P. Marsh Corporation 108
Marshalltown Mfg. Co. 152
Marvel Engineering Co. 59
M. C. Manufacturing Co. 118
Mead Specialties Co. 142
Mechanical Air Controls 60, 61
Mechanisms Inc. 102
Miller Fluid Power Division, Flick-Reedy Corporation 49
Minnesota Rubber Co. 2
Modernair Corporation 22
Jas. A. Murphy & Company 149

National Seal Div., Federal-Mogul-Bower Bearings, Inc. 54
New York Air Brake Co., Kalamazoo Division 17
Niagara Blower Co. 48
C. A. Norgren Co. 52

Oilgear Co., The 13
Ortman-Miller Machine Co., Inc. 63

Page Belting Co. 154
Palley Supply Co. 138
Parker-Hannifin Corp., Parker Fittings & Hose Div. 135
Pathon Mfg. Co. 51
William S. Pine 142
Plastic & Rubber Products Co. 99
Pneu-Trol Devices, Inc. 139
Power Jacks, Ltd. 112
Precision Rubber Products Corp. 11
Protective Closures, Inc. 101

Racine Hydraulics & Machinery, Inc. 105
Republic Manufacturing Co. 102
Roper Hydraulics, Inc. 145
Rosaen Company 136
Ross Heat Exchanger Div., American Standard 15
Rotherm Engineering Co., Inc. 90

Savery, Thomas, Pumps Ltd. 156
A. Schrader's Son, Div. of Scovill Mfg. Co. 89
Sealol Corp. 155
Sheffer Corporation 90
Shell Oil Co. 115
Simplex Engineering Co. 20
Skinner Electric Valve Div., The Skinner Chuck Co. 12
Snap-Tite, Inc. 65
Socony Mobil Oil Co., Inc. 34, 35
Sonnet Tool & Mfg. Co. 140
S-P Manufacturing Corp. 42
Stratoflex, Inc. 130
Sun Oil Company 43
Superior Tube Company 56, 57

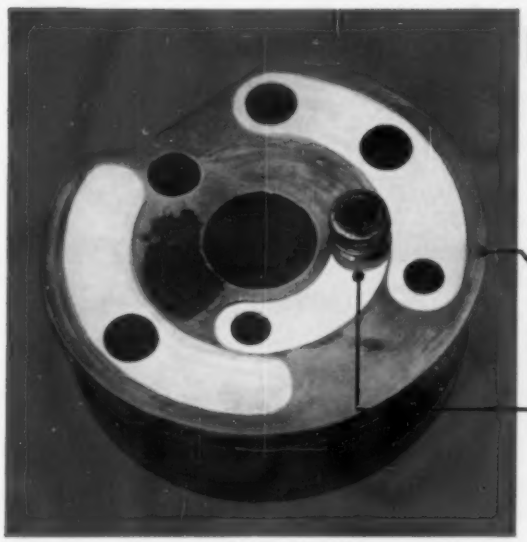
Teer-Wickwire & Co., Lindberg Air & Hydraulic Div. 86
Texas Company 68
Tomkins-Johnson Co. 7
Tru-Flate, Inc. 139
Tru-Seal Division, Flick-Reedy Corporation 149
Tube Reducing Corp. 26

Union Carbide Chemicals Co.
Div. of Union Carbide Corp. 153
United Metallic "O" Ring Corp.
Division of United Aircraft Products, Inc. 127
U. S. Gasket Co.
Plastics Div. of The Garlock Packing Co. 122
U. S. Gauge Division, American Machine Metals Inc. 141

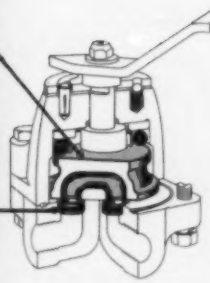
Valcor Engineering Corp. 37
Van Products Co. 136
Versa Products Co., Inc. 138
Vickers, Inc., Division of Sperry Rand Corp.
Machinery Hydraulics Div. 55
Mobile Hydraulics Div. 87
Vickers-Armstrongs, Engineers Ltd. 27
Victor Equipment Co. 33
Henry Vogt Machine Co. 83

Waterman Engineering Co. 62
Watts Regulator Company 97
Weatherhead Company 41
Webster Electric Co. 25
Weldon Tool Co. 129
Westinghouse Air Brake Co.
Industrial Products Division 6
Franklin C. Wolfe Co., Div. of Parker-Hannifin Corp. 125
Wooster Div., Borg-Warner Corp. 39

IN HIGH PRESSURE WATER SERVICE (3000 to 10,000 P.S.I.) ONLY BARKSDALE VALVES HAVE LASTED LIKE THIS WITHOUT MAINTENANCE



Note the mirrorlike sealing surfaces on this Dual Pressure Valve rotor after 4 years of service.



6000 P.S.I. Four-Way Standard Porting

1856 MODELS TO FIT YOUR NEEDS

4-Way, Manipulator, Dual pressure and Shut-off Valves from ¼" to 1½" N.P.T.

3000 P.S.I. Manipulator Manifold Porting

3000 P.S.I. Four-Way Straight Porting

In steel mills, on extrusion presses, die casting machines, rubber and plastic molding presses and on blowout preventers, they have performed without maintenance longer than any other type of valve.

6000 P.S.I. Dual Pressure Standard Porting

THIS LONG, MAINTENANCE-FREE SERVICE

is possible because the metal-to-metal sealing surfaces are self-aligning and actually improve with use through continued lapping action. Sealing qualities do not diminish because a spring compensates for the wear.

DIRT CANNOT SCORE SEALS

because flow is through "Shear-Seals," sealing surfaces remain in constant intimate contact.

COMPLETE CONTROL OF YOUR CIRCUIT

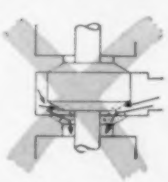
because "Shear-Seal" design is excellent for throttling. It permits opening to any desired degree of flow – smooth action without fighting fluid pressure.

The "Shear-Seal" action eliminates line surges and the round tubular flow passages provide more flow and velocity capacity (up to 60 ft. per sec.) because they are unobstructed by spools or poppets.

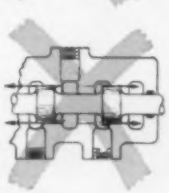
This is why we don't use

SPOOL OR POPPET DESIGN

POPPETS SCORE



SPOOLS LEAK



3000 P.S.I. Shut-Off

10,000 P.S.I. Shut-Off

"Shear-Seal"

Write for Catalog 58-59

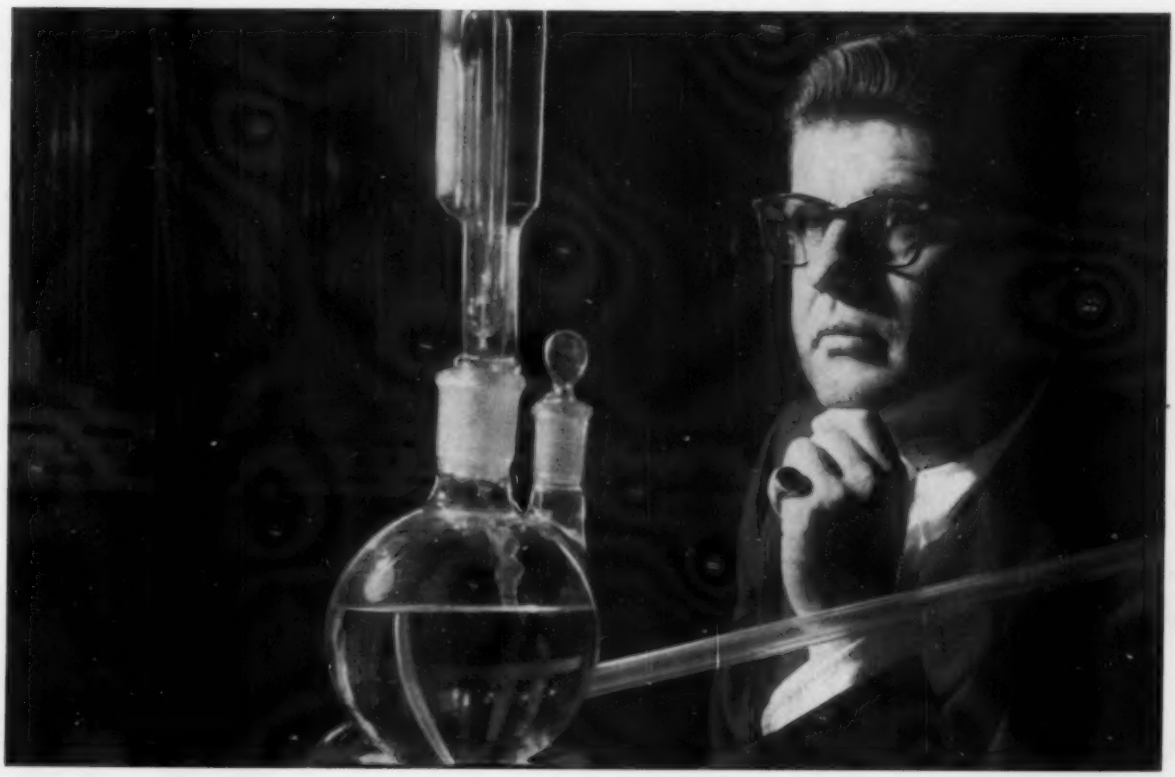
barksdale valves CONTROL VALVE DIVISION

5125 ALCOA AVENUE • LOS ANGELES 58, CALIFORNIA

CIRCLE 18 ON READER SERVICE CARD

He runs the only distillery in the business press

His name is David Kinsler. He distills writing! Every line in every issue of Applied Hydraulics Magazine goes through his still. When it comes out, it's DISTILLED WRITING.



Why Distilled Writing? Mr. Reader is a busy man. If he read everything that crosses his desk, he'd never get his job done. He reads magazines that are easy to read.

So he reads Applied Hydraulics Magazine. The editorial is distilled: extra words—but none of the facts—are squeezed out. What's left makes clear, concise, bright reading. Distilled Writing makes articles shorter, makes room for more articles to attract more readers in each issue. It helps readers get more facts quicker.

Result: Better readership for Applied Hydraulics, more value for your advertising dollar.

DISTILLED WRITING

FRANCHISE CIRCULATION

Applied Hydraulics

The Magazine of Fluid Power

812 HURON RD. • CLEVELAND 15, O. • SUperior 1-9622

New York 17,
Rm. 836, 60 E. 42nd St.
Tel. Murray Hill 7-3420

Chicago 11,
Rm. 704, 520 N. Mich. Ave.
Tel. WHitehall 3-1655

Los Angeles 57,
Rm. 8, 672 S. Lafayette Park Pl.
Tel. DUnkirk 7-5104

London, England
John A. Lankester,
31 Palace St.
Westminster, London S.W. 1